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Nuclear Effects Data Management and Analysis System (NEDMAS)

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13. ABSTRACT (Maximum 200 words) This report describes the functionality and usage of experimental software written to facilitate access to DSWA archival data collected from U.S. above-ground nuclear tests. Specifically, it provides a detailed description of the version of NEDMAS that has been implemented at Maxwell Federal Division, Inc.'s Reston, Virginia office and installed at DSWA Headquarters as part of the DARE effort. In its current configuration, the system contains a database of approximately 1000 pressure time series from 24 events in 3 series, as well as some preliminary fireball photography, cratering data, and ground motion data, comprising altogether about 6MB of data. An overview of the functionality of the software is presented in the main body of the text; installation and startup instructions, a sample session, and a comprehensive reference are presented in appendices.			
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SUMMARY

In this report we present a description of the research investigations directed toward the development of the Nuclear Effects Data Management and Analysis System (NEDMAS). In its current configuration, NEDMAS is applicable to above-ground nuclear explosions at the U.S. Nevada Test Site and encompasses an online database of approximately 1000 pressure time series from 24 events in 3 series, as well as some preliminary fireball photography, cratering data, and ground motion data. Total data volume at the time of this report is about 6 MB. Information regarding the explosion source environment is presented to the analyst in the context of a SPOT[®] satellite image of the site surrounding the detonation point, together with associated surface geologic information and DMA topographic data.

The capabilities and functionality of NEDMAS are illustrated in Section 2 using displays of the screens encountered by an analyst in a typical processing session. The selected capabilities displayed in this sample session are related to a more complete definition of the system functionality through references to a series of appendices containing a detailed script of the user actions required to reproduce the sample session (Appendix B); a complete description of all currently-available system options (Appendix C); and information regarding software and hardware implementation requirements (Appendix A). Taken together, Section 2 and its associated appendices provide a concise description of the results of the NEDMAS development effort.

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SECTION 1

INTRODUCTION

Over the past several years, the Defense Special Weapons Agency (DSWA, formerly the Defense Nuclear Agency [DNA]) initiated a series of efforts designed to provide improved access to its archive of nuclear weapons effects data. These efforts have included the creation of the Graybeard data review and evaluation panel (comprising nuclear weapons effects experts who participated in the United States' atmospheric nuclear testing programs) and several software and computer-based archive projects. Among the computer-based projects were the Nuclear Effects Data Management and Analysis System (NEDMAS), the subject of this report; and the Data Archival and Retrieval Enhancement (DARE) system. The NEDMAS project aimed to permit the user to access various data from aboveground tests via a graphical user interface, to make it possible to compare data between tests, and to allow comparison of observed data with modeled data.

In its current configuration, the system is applicable to above-ground nuclear explosions at the United States' Nevada Test Site (NTS) and contains a database of approximately 1,000 pressure time series from 24 events in 3 series, as well as some preliminary fireball photography, cratering data, and ground motion data, comprising altogether about 6 MB of data, as received from DASIAC. In addition, it contains about 800 KB of data generated by a sophisticated finite-difference modeling application; approximately 100 megabytes of image data including photographs scanned from contemporary reports and a SPOT[®] satellite photograph of the test site; geologic data; and topographic information derived from DMA sources. Information is presented to the user in the context of SPOT[®] satellite images of the area immediately surrounding the detonation points at NTS.

The user interface to the system has been designed to be completely menu-driven and mouse-activated and requires no keyboard entry by the user once the system has been started. This graphical user interface has been built using the X Window system; X was designed specifically to allow hardware independence, to foster ease in porting applications to machines other than those on which they were developed, and to permit running of applications on one computer while displaying their output on another, even if the computers are of different manufacture. NEDMAS was designed and implemented on Sun SPARC computers, but transfer to any other system that supports X Windows and UNIX could easily be accomplished.

NEDMAS comprises a suite of applications. The front end is a program that performs most of the work of showing data in context and providing menu- and mouse-click access to pressure and other data. Auxiliary applications display recorded data, modeling results, and summaries of data. All the software has been written in C or FORTRAN. C was chosen because the application programmers' interface to X Window procedures is in C and because C is well suited to the design of complex systems with a variety of data structures. FORTRAN was used for certain legacy applications, particularly the modeling programs, with C and X front ends grafted on for purposes of displaying the results of the calculations to the user. Database functions are performed by procedures written as part of the NEDMAS effort. The database structure is compatible with commercial database management systems such as Oracle.

This document provides a summary report of the initial development of NEDMAS. In the next section, the capabilities and functionality of the system are illustrated using captured screen images that would be encountered by a user in a typical session. A detailed script leading to the displays shown in Section 2 is provided in Appendix B. A comprehensive description of all NEDMAS controls and options is presented in Appendix C.

SECTION 2

OVERVIEW OF NEDMAS CAPABILITIES

In this section, some of the capabilities and functionality of the Nuclear Effects Database Management and Analysis System (NEDMAS) will be illustrated through images of the screens encountered in a typical session. For this example, unclassified data from series Plumbbob events Smoky and Priscilla and series Teapot event MET will be examined to illustrate features of the system. A detailed script of the operator actions required to reproduce this sample session is provided in Appendix B.

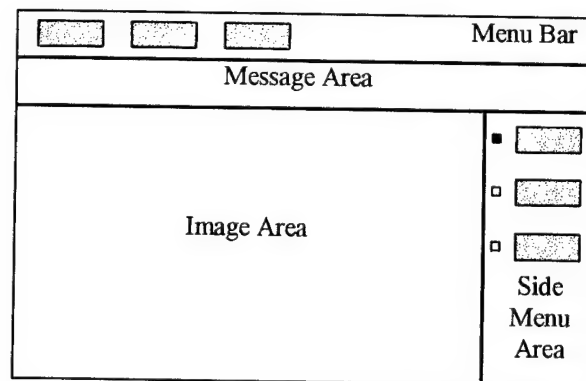


Figure 2-1. General appearance of NEDMAS applications.

The layouts of the NEDMAS application modules follow the pattern shown in Figure 2-1. The parts of the display are as follows:

- menu bar - an area at the top of the display that contains buttons that cause menus to be displayed
- message area - a strip just under the menu bar that displays short messages from the application
- image area - the main display area of an application
- side menu area - an area to the right of the image area that contains switches to control the functionality of the mouse. When a particular mouse function is selected, an indicator is illuminated next to the name of the function.

All applications in NEDMAS use the same layout, though not all applications use all parts shown.

We will present this overview of NEDMAS functionality by showing a series of screen images taken from a sample session. Each image has accompanying text describing the content of the screen.

The initial NEDMAS display is reproduced in Figure 2-2; a compressed (70 meters per pixel) SPOT® image of NTS is shown in the context of the test site information interface. The main menu contains the menu-access buttons *Effect*, *Series*, *Events*, *View*, *Data*, *Images*, *Overlays*, *Function*, *Copy*, *Help*, and *Quit*. The *Events*, *View*, *Data*, and *Images* menus are context-sensitive; that is, they contain data relevant to the current state of the application. When the application is first launched, the *Events*, *View*, and *Data* menus are empty, but are filled in as choices are made.

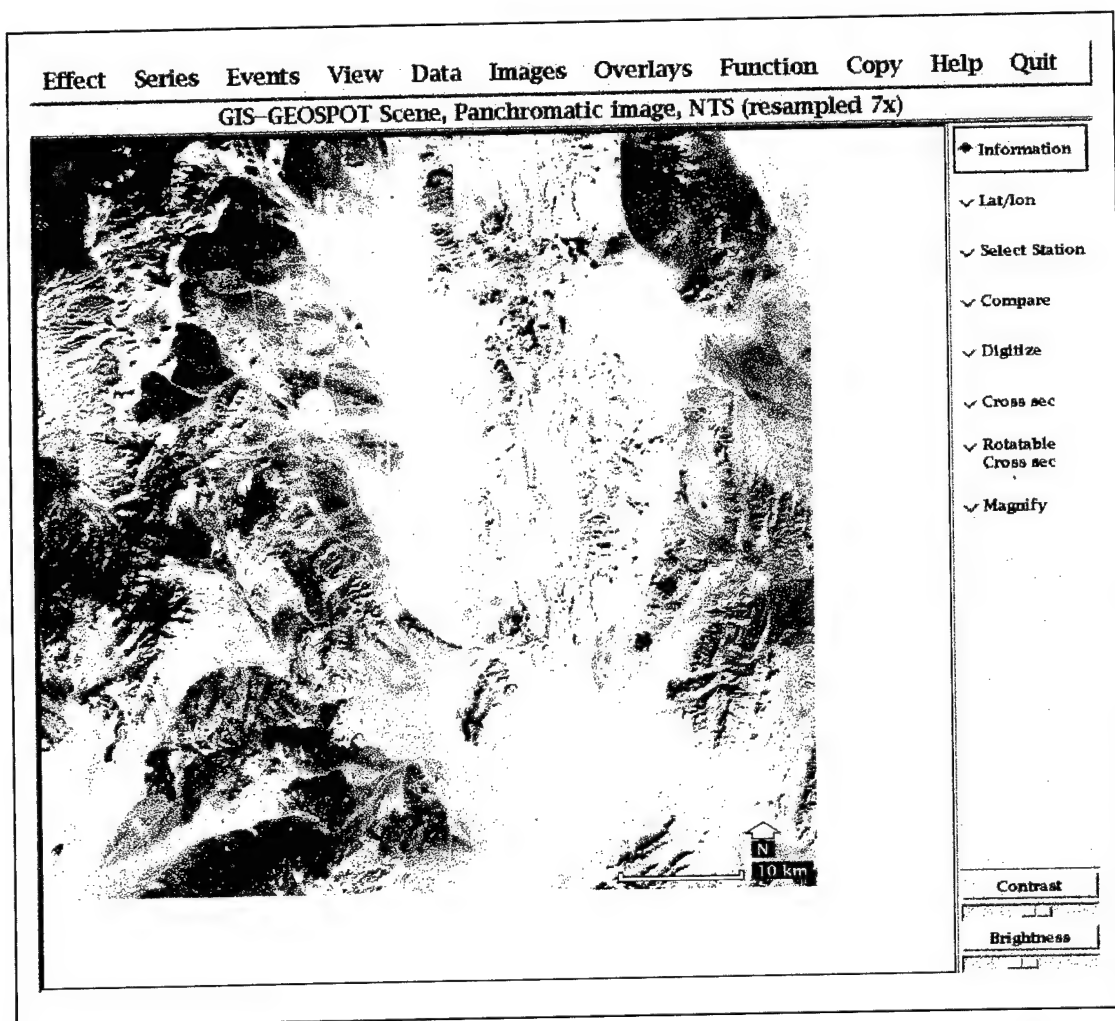


Figure 2-2. Initial screen from NEDMAS.

Before presenting the overview of NEDMAS, a description of the effects of the various menus on the main image display will be presented. Figure 2-3 shows the main NEDMAS menu and its submenus as they would appear after selections of Series and Event have been made.

The **Effect menu** gives the user the ability to limit the type of data that will be accessed. When fully implemented, it will cause downstream menus, for example the Series Menu, to show only those series, events, and so on that contain data of the desired effect type.

The **Series menu** allows the user to select which of the several available series of nuclear explosion tests is to be examined. When NEDMAS is first started, none of the *Events*, *View*, or *Data* menus contain any entries; the *Images* and *Overlay* menus contain a few items that are relevant to NTS as a whole as well as some images of general interest. Upon selecting a series, the context-sensitive menus fill in with items relevant to the series, and the locations of events from the series are shown on the SPOT® image of NTS as icons (red boxes with a center dot to indicate the detonation point). To proceed, the user selects one of the available Series from the menu.

The **Events menu** is filled in with events from a particular series once a series has been selected. Contents of the menu are built from a database of events available to NEDMAS. To select an event, the user presses the *Events* menu button and chooses one of the listed events. Upon selection of an event, the context-sensitive menus fill in with data relevant to the selected event, while a green diamond outlines the location of the event on the SPOT® image.

Effect	Series	Events	View	Data	Images	Overlays	Function	Copy	Help	Quit
GIS-GEOSPOT Scene, Panchromatic Image, NTS (resampled 7x)										
Effect Nuclear Effects selection Airblast Ground Shock Cratering Fireball	Series Series selection Hardtack Plumbbob Teapot Tumbler Upshot-Knothole Small Boy Sedan	Events Event selection Apple I Apple II Bee Hornet Met Moth Post Tesla Turk Wasp prime Zucchini	View View selection SPOT image, MET Topographic data Geologic data	Data Data selection Overpressure Dynamic Pressure Total Pressure Static Pressure Mach Number Ground Motion Cratering Fireball Photography	Images Image selection Aerial Photos Airblast Schematic Instrumentation	Overlays Overlay selection Met Overlay West to Tower Northeast to Asphalt North to Asphalt Northeast to Water South to Water Digitized overlays	Function Function selection Plot pressures Plot peaks Plot times Plot HOB Priscilla Airblast Calculation Save overlay	Help Select a help page Overview Effect Menu Series Menu Events Menu View Menu Data Menu Images Menu Overlays Menu Function Menu Copy button Quit button Side buttons and controls		

Figure 2-3. The NEDMAS Main Image Display main menu, message area, and submenus.

Once an event is selected, the **View menu** fills in with a set of views available for the chosen event. As currently configured, NEDMAS provides a full-resolution (10m/pixel)

SPOT® image of NTS immediately surrounding the event's detonation point, a color-coded topographic map of the area around the detonation point, and a general geologic map for NTS as a whole. Whichever view the user selects, the application displays the image and indicates the location of the event's detonation point with an icon. All views chosen in this way are registered to geographic coordinates, so overlaid icons may be displayed equally well on all views.

The **Data menu** contains a list of available data for the selected event. Such data may include overpressure, dynamic pressure, total pressure, static pressure, Mach number, fireball photography, ground motion, and cratering data as available. Since all data types are not available for all events, only the relevant types are shown for a specific event. When the user selects a data type from this menu, locations of instruments that collected the data are shown on the image, represented by yellow boxes with center dots representing the instrument locations. The sample menu in Figure 2-3 shows a sample data menu as it would appear if all of the effects data types could appear at once.

Images specific to the chosen event are accessible via the **Images menu**. The user may elect to view any image at any time by selecting one from the menu. After looking at the images, the user must restore the View by selecting the appropriate entry from the *View* menu. Selections having a right-pointing arrow on the item bring up a submenu.

The **Overlays menu** gives the user access to digitized line data for the specified event. It also provides access to data digitized by the user, as discussed below. The final entry in each *Overlay* menu, called Digitized overlays, brings up a submenu containing overlays that have been constructed via the digitization feature of NEDMAS.

The **Functions menu** is partly context-sensitive. That is, its contents do not vary according to the selections made in the Series and Events menus, but the data used in some displays depends on the selections. Its contents and their functions include:

- Plot Pressures - plot pressures as recorded at selected instruments.
- Plot Peaks - for the selected event, display a plot of Peak Pressure versus Range.
- Plot Times - for the selected event, display a plot of Arrival Time versus Range.
- Plot HOB - for the selected event, plot scaled height-of-burst versus scaled range.
- Priscilla Airblast Calculation - present graphical results of an off-line finite difference calculation for series Plumbbob event Priscilla.
- Save Overlay - this provides a mechanism by which the user can save digitized overlays.

The **Copy button** on the Menu Bar captures the image to a file. When the user presses this button, a dialog box asks for the name of a file to which the screen image is to be saved. Screen images are saved to whatever directory the user was in when NEDMAS was launched in a form suitable for output to a printer.

The **Help menu** provides access to a series of pages of text describing how to use every NEDMAS application

Pressing **Quit** causes the application to terminate execution.

Finally, the menu along the side of the main image display controls actions that take place when the mouse button is pushed.

In this example, we will select *Series*⇒*Plumbbob* and *Events*⇒*Priscilla* to generate a display like Figure 2-4, showing the locations of all the events of the Plumbbob series with the Priscilla event, in the south-central part of the image, highlighted by a diamond. The area immediately around the selected event can be shown in various ways by accessing the *View* menu; the choices are a SPOT® image at full 10 meter resolution, color-coded elevation, or color-coded surface geology.

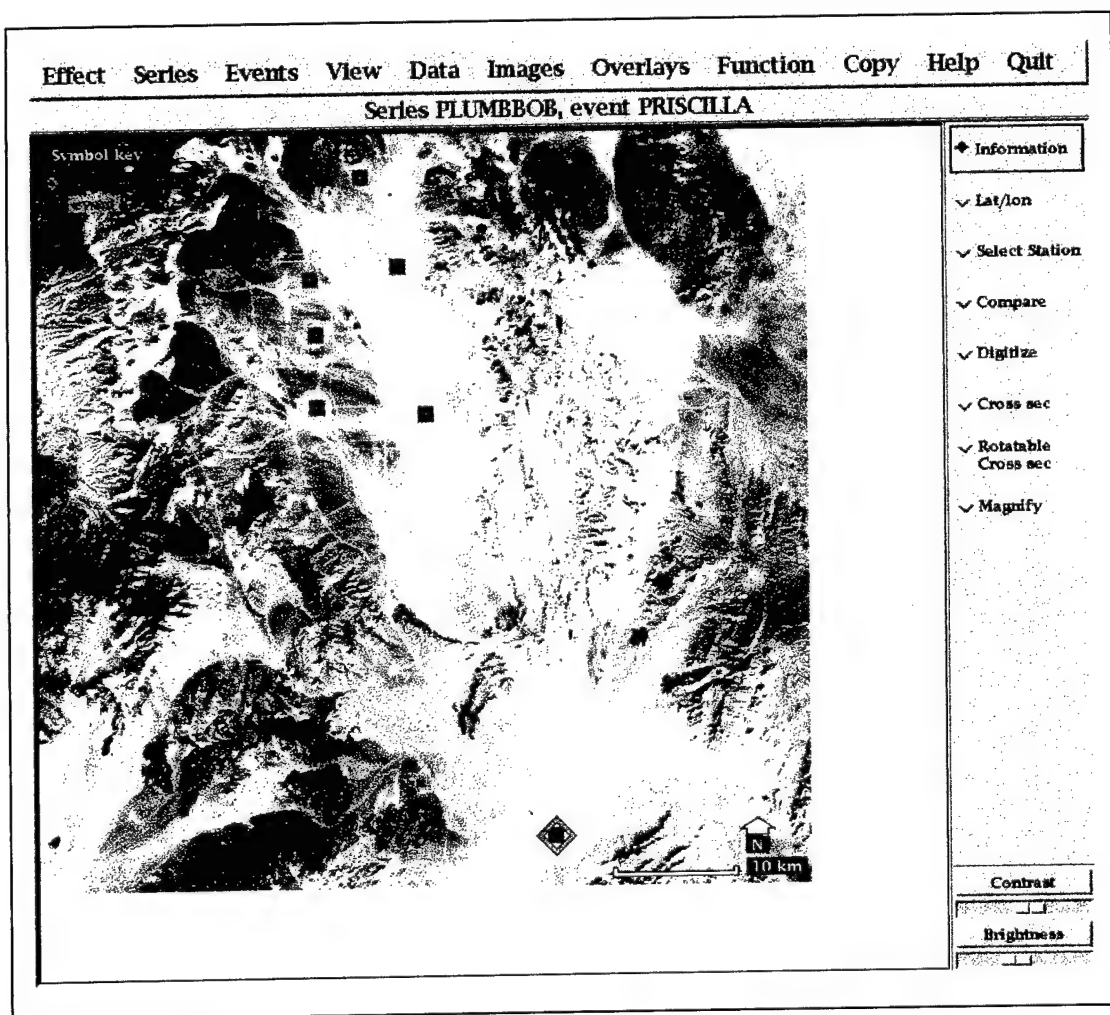


Figure 2-4. Series Plumbbob with event Priscilla highlighted.

Figure 2-5 shows the full-resolution SPOT® image surrounding the detonation point of series Plumbbob event Priscilla. The detonation point is indicated by the square at the center of the satellite image, shown here in white but in color on a computer display. Within NEDMAS, all events have associated full-resolution satellite images centered around the event's detonation point.

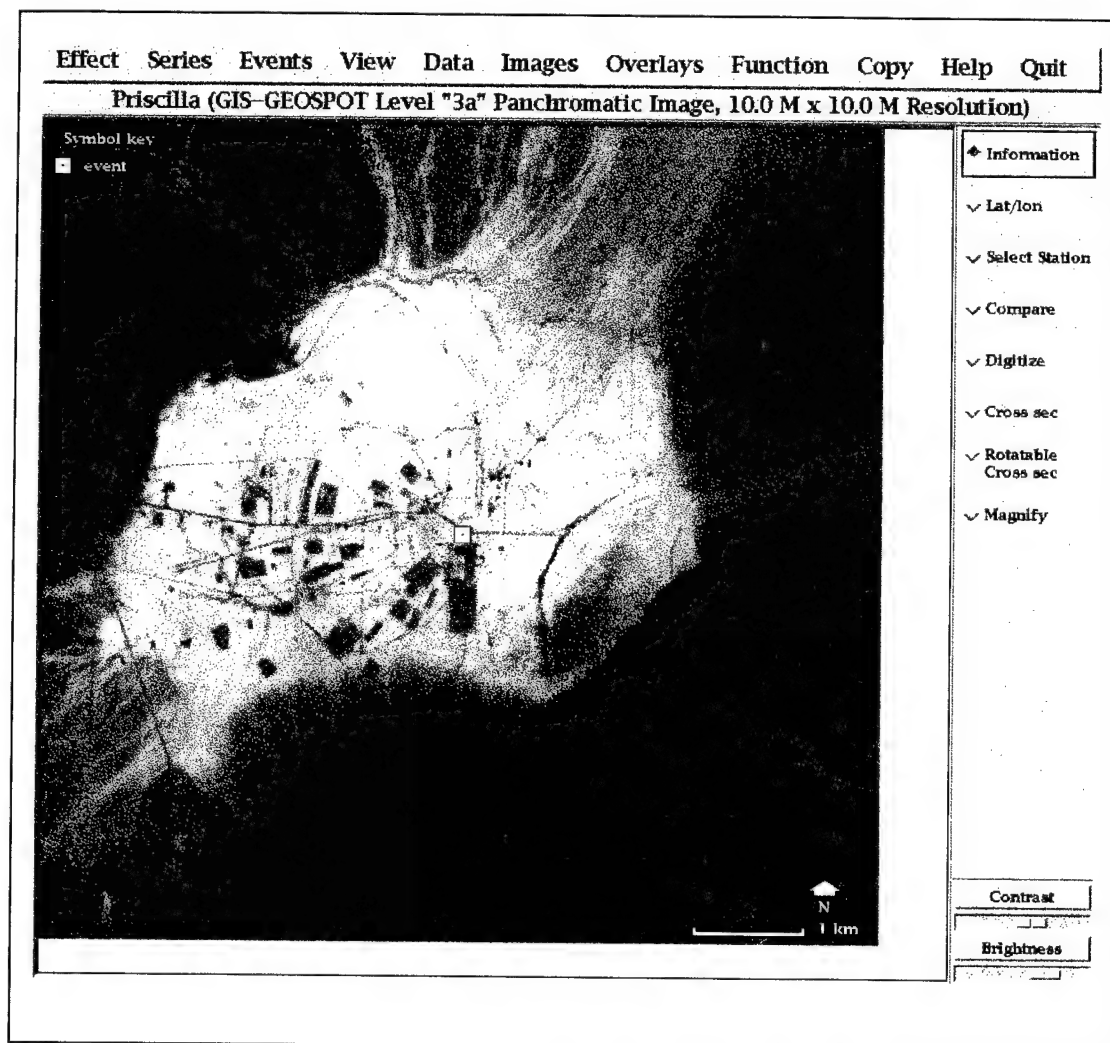


Figure 2-5. Full-resolution satellite image of area near Plumbbob/Priscilla..

The image display will respond to mouse clicks according to the state of the mouse-action buttons in the side menu. With the information toggle chosen, placing the mouse cursor into the box indicating the detonation point of any event will cause an information box to appear, as shown in Figure 2-6. Most objects that appear in NEDMAS displays can be queried in this way.

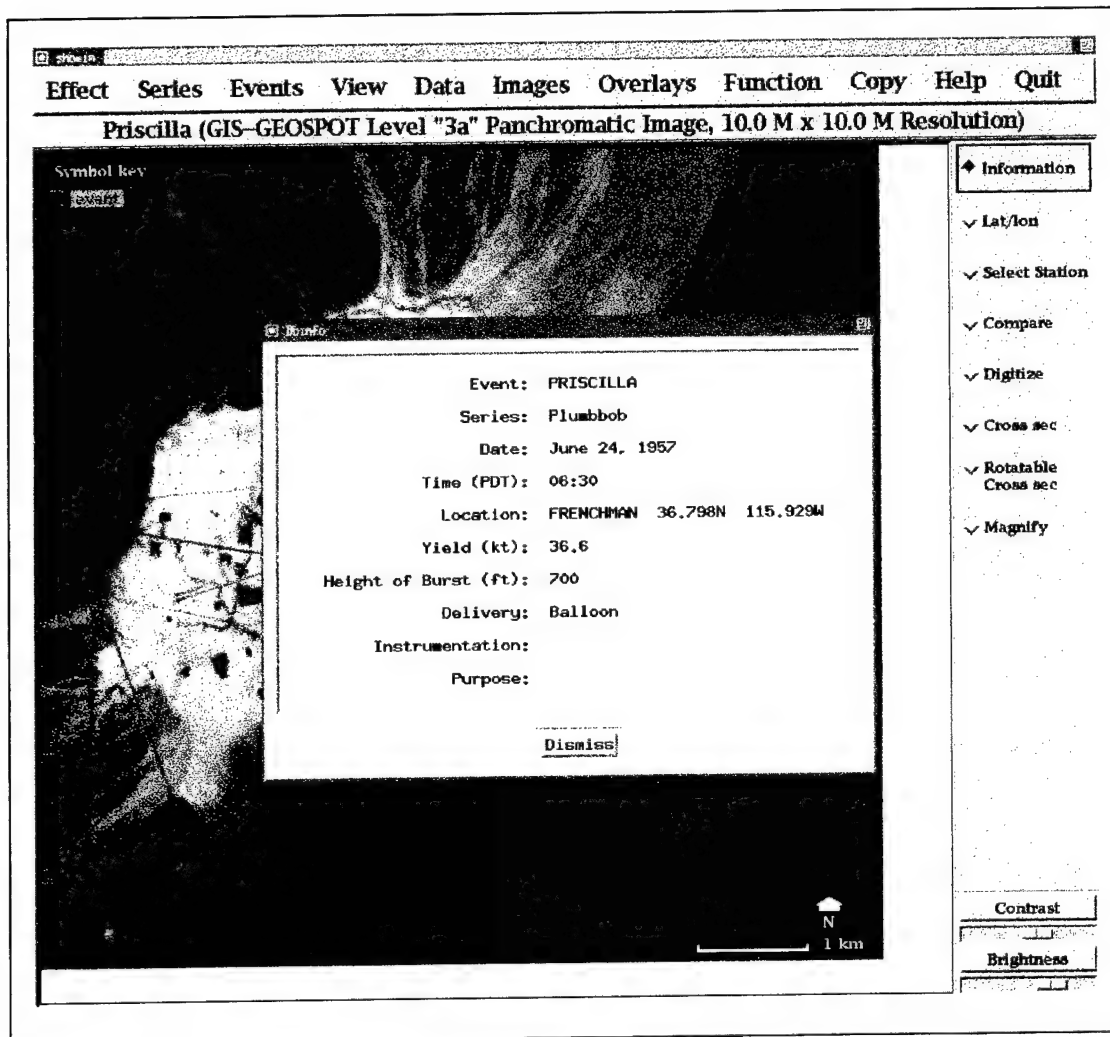


Figure 2-6. An information dialog box.

Other functions of the mouse include magnifying the display, taking cross-sections through the elevation data, digitization of features that are visible on the display, selection of data-collection stations for examination, and latitude and longitude of selected points. One selects a function for the mouse by clicking on the function's name in the side menu, then exercises that functionality by clicking in the image area. For example, Figure 2-7 shows a magnified version of a portion of the display of the SPOT® image around the Sedan crater, achieved by selecting *Magnify* from the side menu, then clicking near the center of the crater visible in the image.

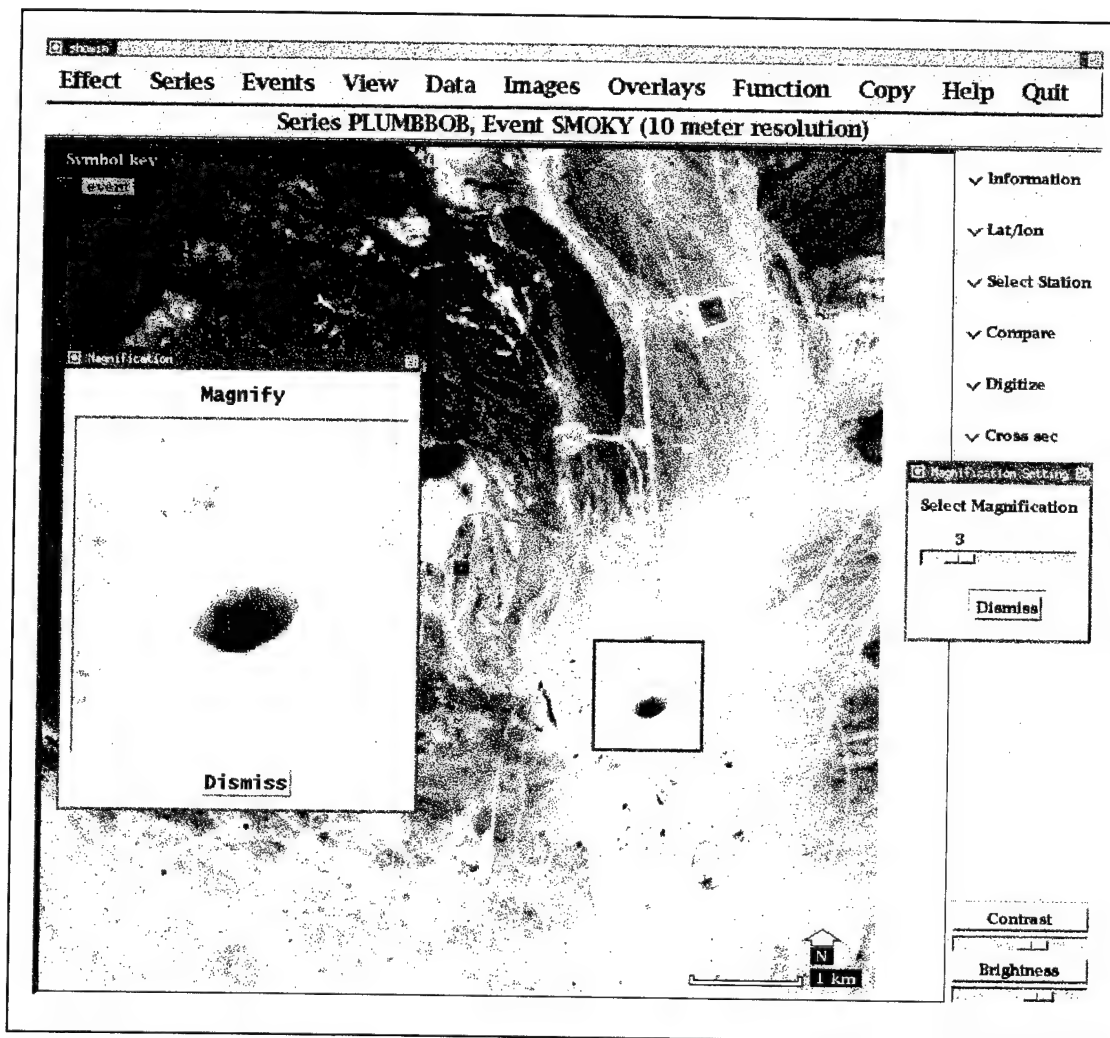


Figure 2-7. A magnification of part of a satellite photo.

Often, there are photographs and images from reports associated with particular events. The Images menu will contain the list of images available for a particular event under examination. For event Smoky, one available image from that menu (*Images⇒Aerial Photos⇒Southeast to Tower*) is shown in Figure 2-8. This image is a photograph taken prior to the Smoky explosion, looking from the northwest toward the tower used to house the Smoky device; notice particularly the hill visible in the foreground.

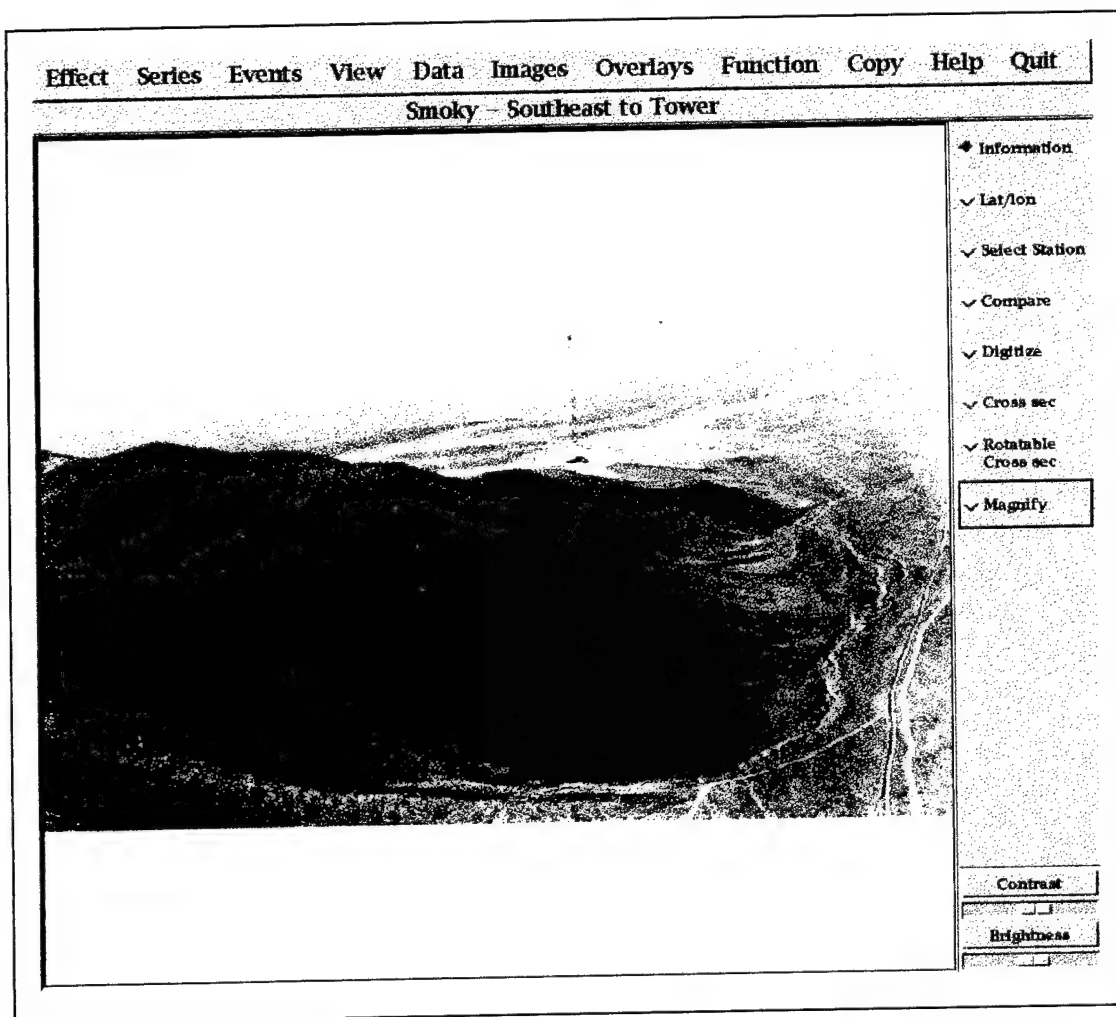


Figure 2-8. Pre-detonation photograph near Plumbbob/Smoky.

Topography is viewable in several ways. One way to view it is to take a cross-section along a line specified by two mouse clicks, as shown in Figure 2-9. In this cross-section, the hill that was visible in the foreground of Figure 2-8 is shown in profile. Another way to show topography is to display a color-coded topographical map, by selecting *View⇒Topographic data* from the main menu bar.

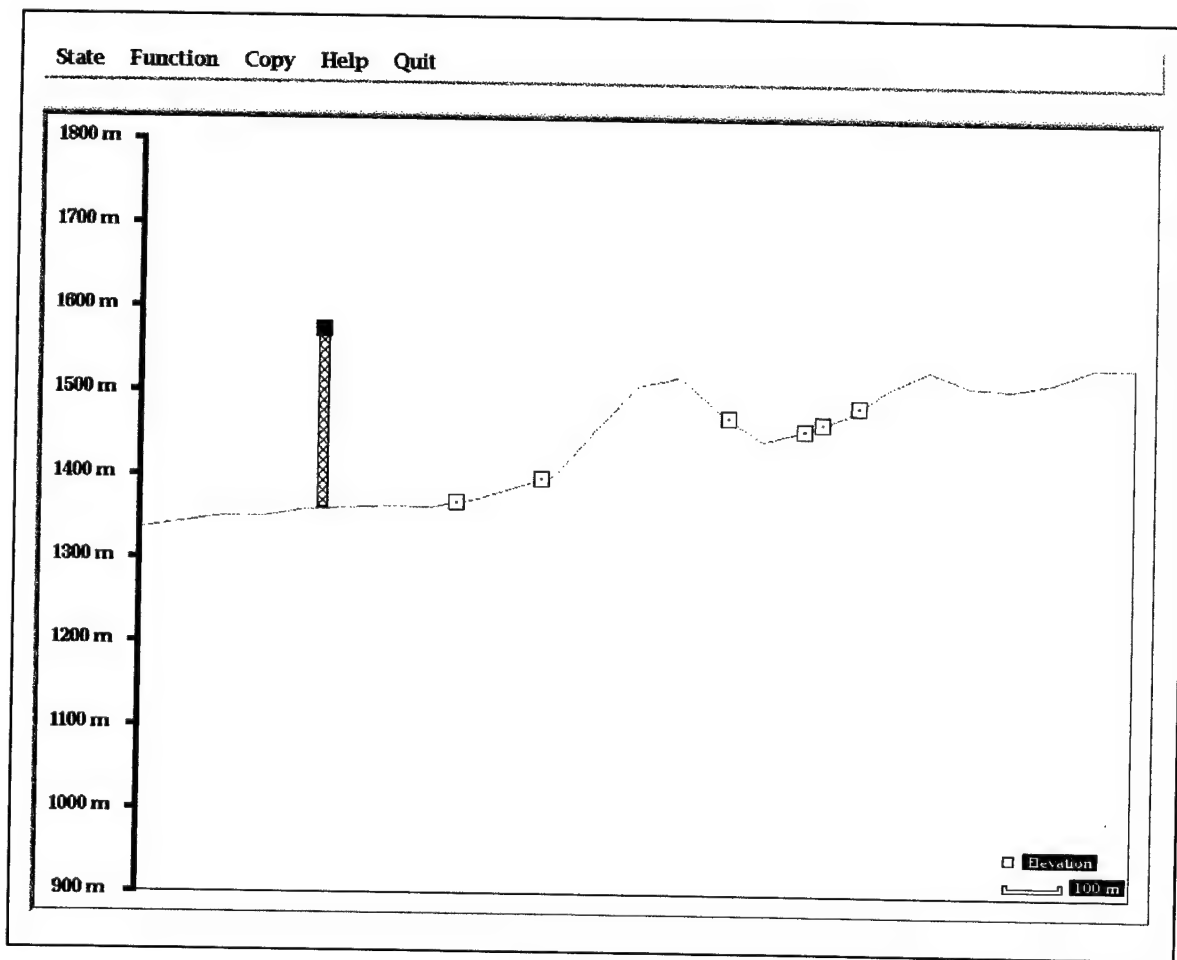


Figure 2-9. Cross-section along a line SE-NW near Plumbbob/Smoky.

A third way to view topography is as a 3D wireframe display, as shown in Figure 2-10. Here, the view is from the southeast toward the hillside, i.e., almost opposite the viewpoint of Figure 2-8; the hillside is visible as a rise in the background of the wireframe.

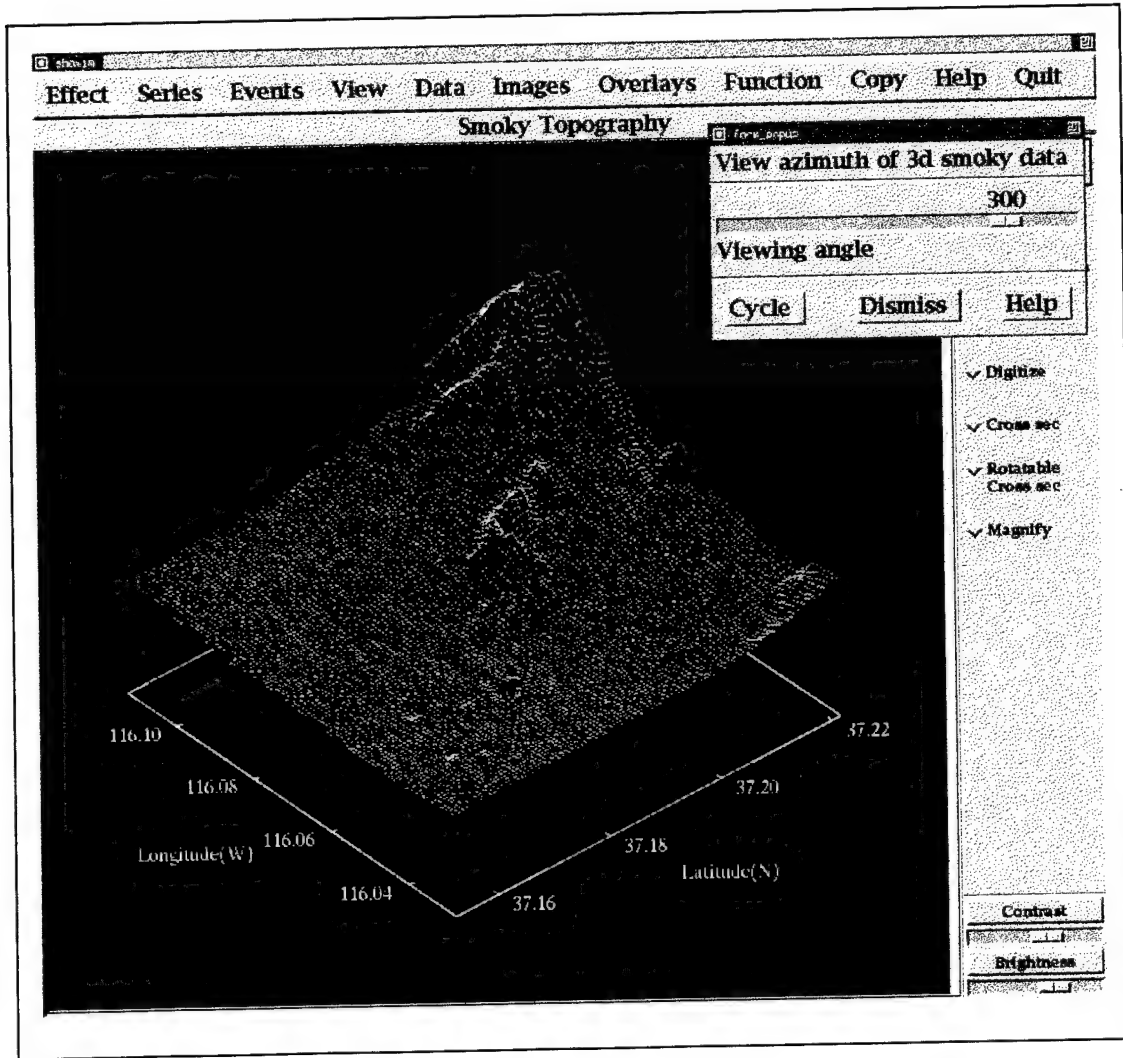


Figure 2-10. Wireframe image of hillside near Plumbbob/Smoky.

A central feature of NEDMAS is that it permits the user to examine data from NTS atmospheric explosions by means of a graphical interface. Once series and event have been chosen, the user can display locations of instruments that recorded data available on the system by making a selection from the *Data* menu. In Figure 2-11, the overpressure data locations for series Plumbbob event Smoky are shown as light-colored boxes surrounding the detonation point.

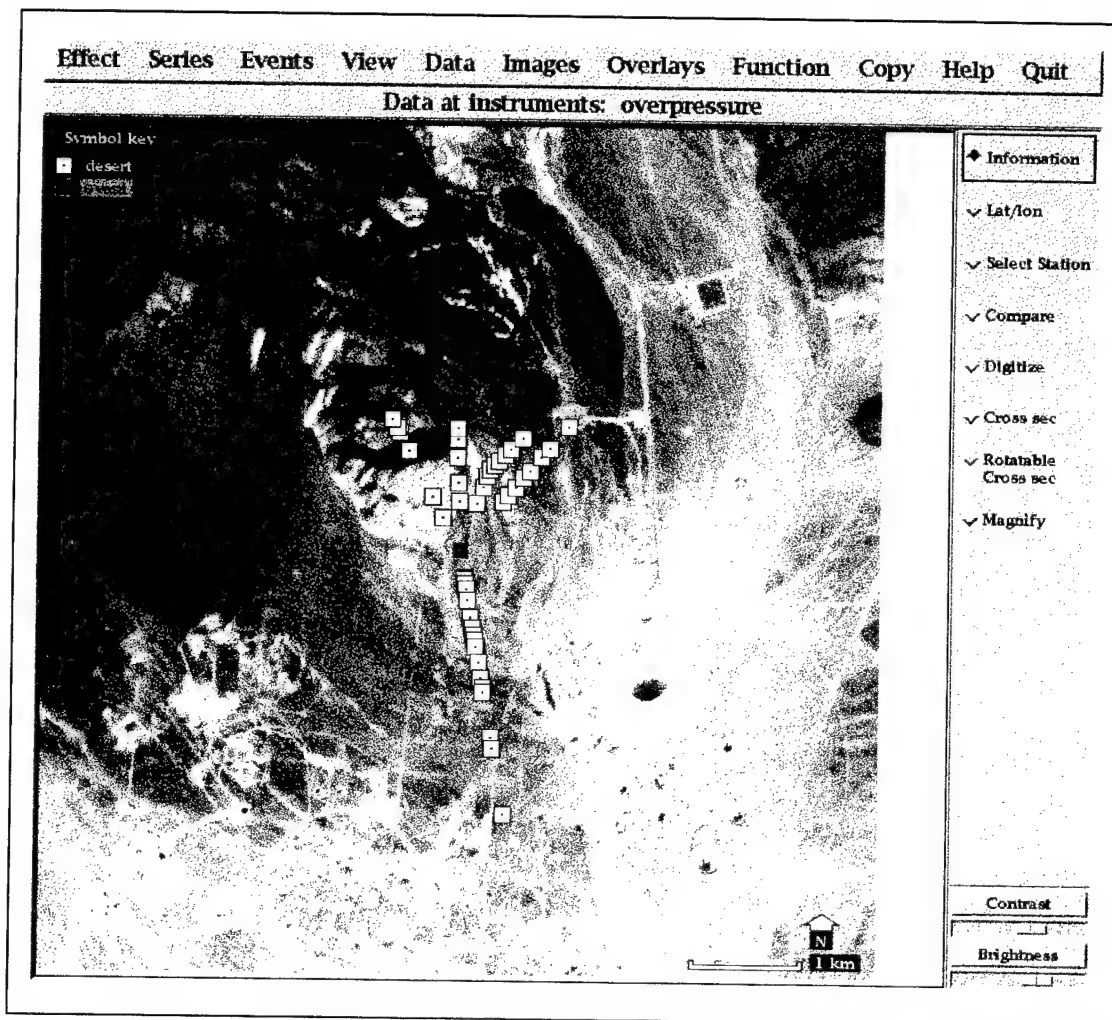


Figure 2-11. Satellite photo of Plumbbob/Smoky area, showing detonation point and instrument locations.

One selects instruments whose data are to be displayed by choosing *Select Station* from the side menu, and then clicking on the locations of individual instrument locations. Comparing Figures 2-11 and 2-12, one can see that selected instrument locations in the

northwest-trending instrument line have been flagged by colored diamonds, indicating that those instruments have been selected for display of data. Similar access to data is provided in cross-section displays provided the user has specified a cross-section line that intersects the locations of data collection points; such a case is shown in Figure 2-9, where the boxes on the ground profile represent instrument locations.



Figure 2-12. Instruments selected from Plumbbob/Smoky.

Once instruments have been selected, one may view the data collected at those stations by choosing *Function*→*Plot Pressures* from the main menu bar. Figure 2-13 shows several overpressure waveforms from the Smoky event along a line northwest of the detonation point. The pressure waveform display will show an arbitrary number of waveforms, but imposes a minimum size limit so that at most six waveforms will be visible at one time; if the number of time series to be displayed is greater than that, a slider will appear at the right of the display that allows the user to scroll the display to view waveforms that are not visible initially. Switches in the display allow the user to look at the data as individually scaled waveforms, or as a set of waveforms that are scaled to a common vertical scale; to select a waveform to move around the screen to overlay on other waveforms for comparison; to show measurements in original units or in standard SI units; to scale all waveforms to a standard explosion size and atmospheric pressure; to view waveforms either as instantaneous overpressure (in units of pressure versus time) or as cumulative impulse (in units of pressure-seconds versus time); and to perform time series modeling using the Brode (Brode 1986) or LAMB (S-Cubed 1983) modeling codes.

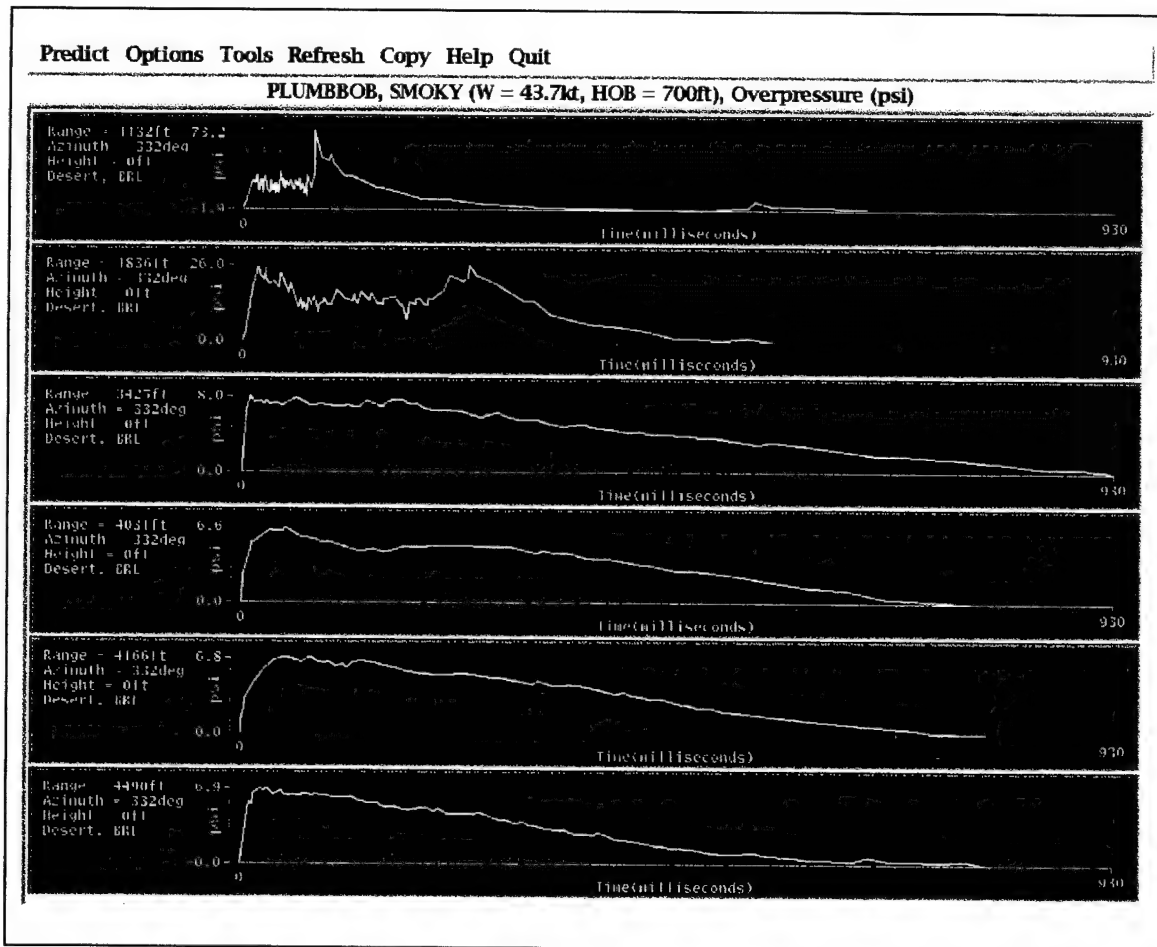


Figure 2-13. Overpressure data from selected Plumbbob/Smoky instruments.

Just as topography was viewable in several ways, so are the pressure data displayable in different formats. Besides the pressure versus time waveforms discussed previously, pressure data may be displayed as peak pressure versus range of instrument from the detonation point, as shown in Figure 2-14, and as arrival time versus range, as shown in figure 2-15.

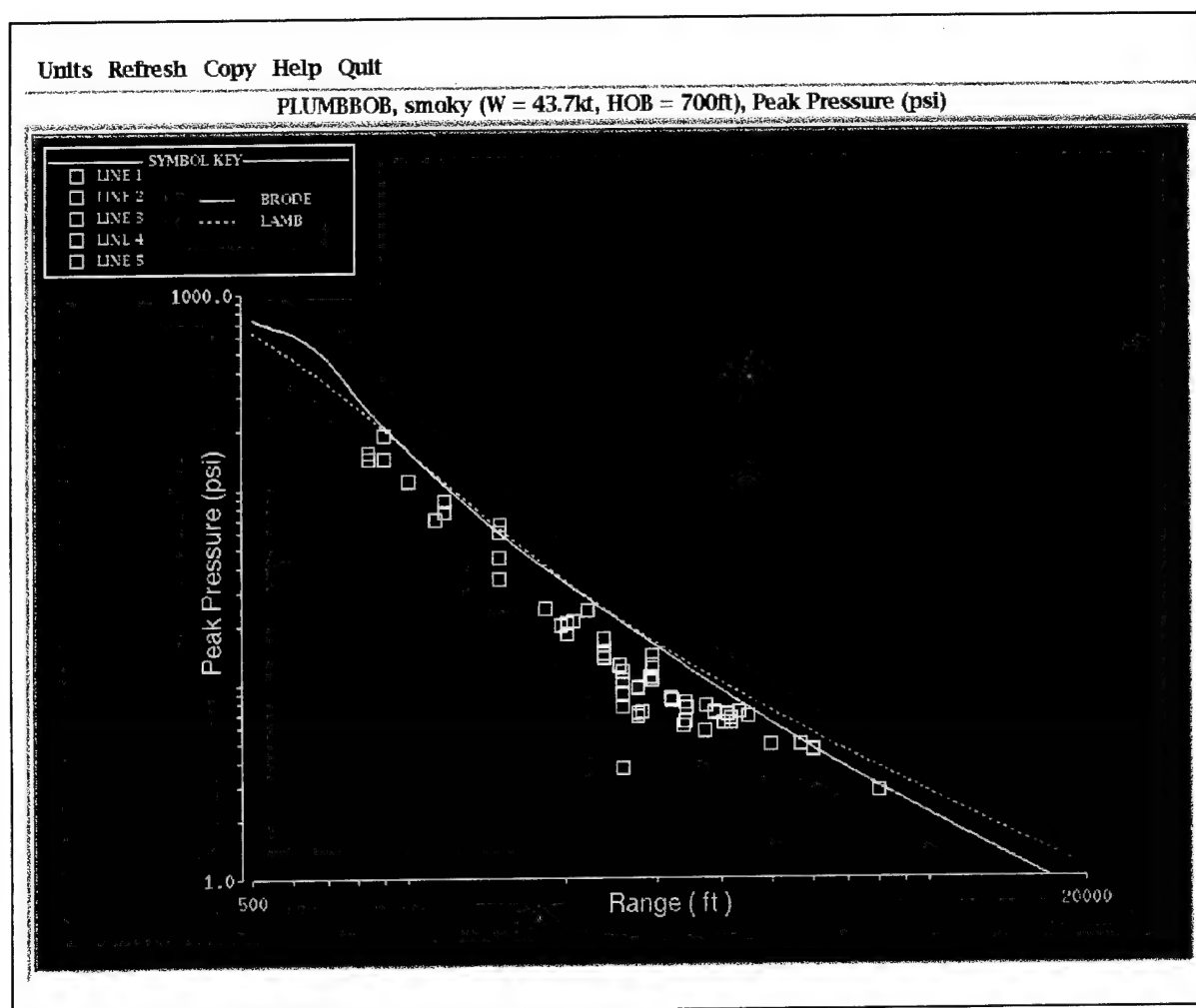


Figure 2-14. Peak pressure versus range for Plumbbob/Smoky.

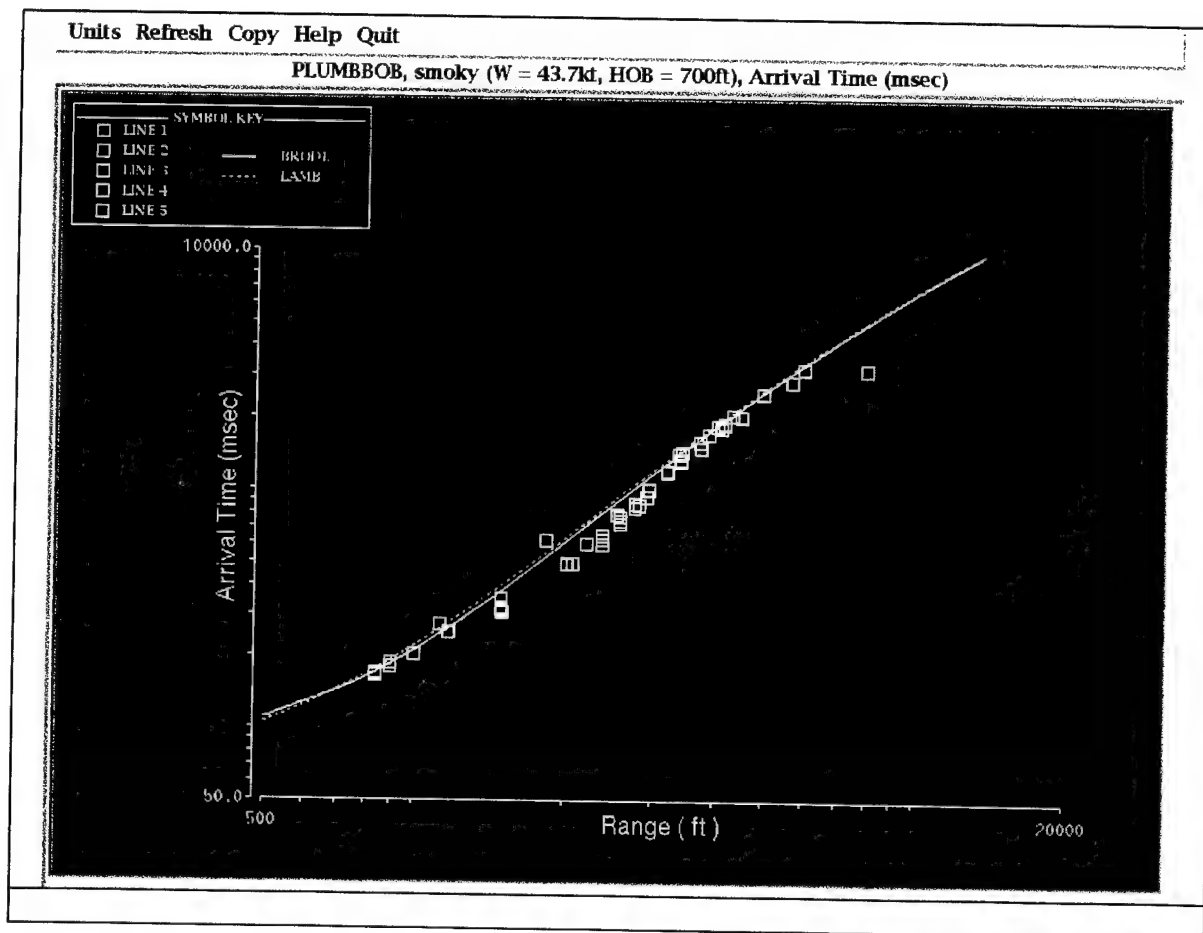


Figure 2-15. Pressure arrival time versus range for Plumbbob/Smoky.

Oftentimes a user will want to compare data, and NEDMAS provides a mechanism to do that. One way to start a data comparison is via the satellite image display. Figure 2-16 shows series Teapot event MET with overpressure instrument locations shown. For Teapot/MET, the three lines of instruments were installed respectively on the desert surface, on a runway-like strip of asphalt, and on a long, wide water-filled trench; in Figure 2-16, these three lines of instruments are represented by differently-colored perpendicular lines of icons. With side menu item *Compare* selected, the user clicks on one instrument location to choose it for displaying data and other instrument locations for that event at similar distances are chosen automatically by the application. Invoking *Function*⇒*Plot pressure* will then show the time series recorded along all three instrumentation lines.

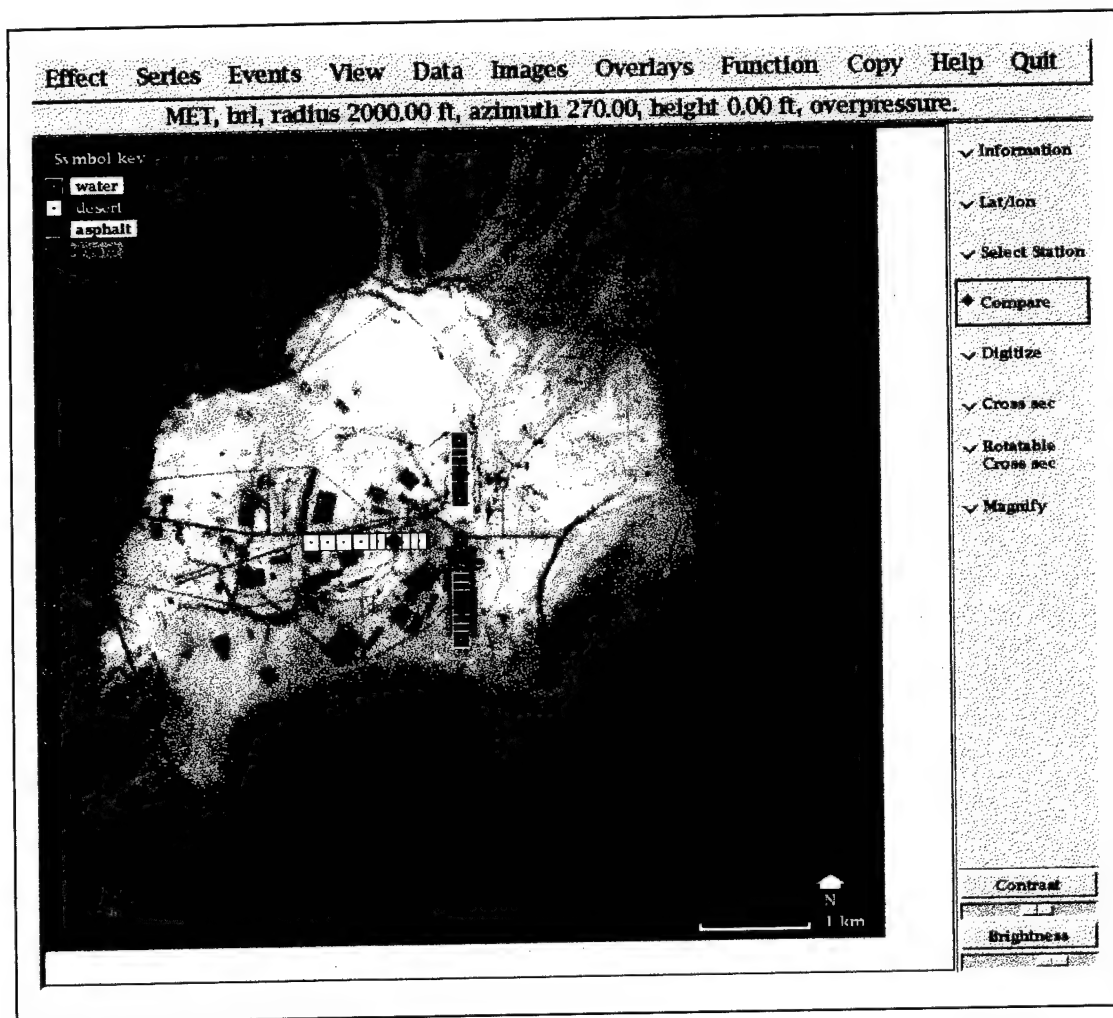


Figure 2-16. Teapot/MET, showing instruments for comparison of overpressure along different instrument lines.

Figure 2-17 shows data from the selected instruments from Teapot/MET, scaled to a common vertical scale, with pressure in units as recorded (PSI). The topmost time series is from an instrument on the desert floor at 2000 feet from the detonation point; the middle time series is from an instrument at the same distance on the asphalt surface; and the bottommost time series is from an instrument at the same distance in the water-filled trench. Viewing the data this way permits the user to examine the effects of surface environment on pressure from an explosion.

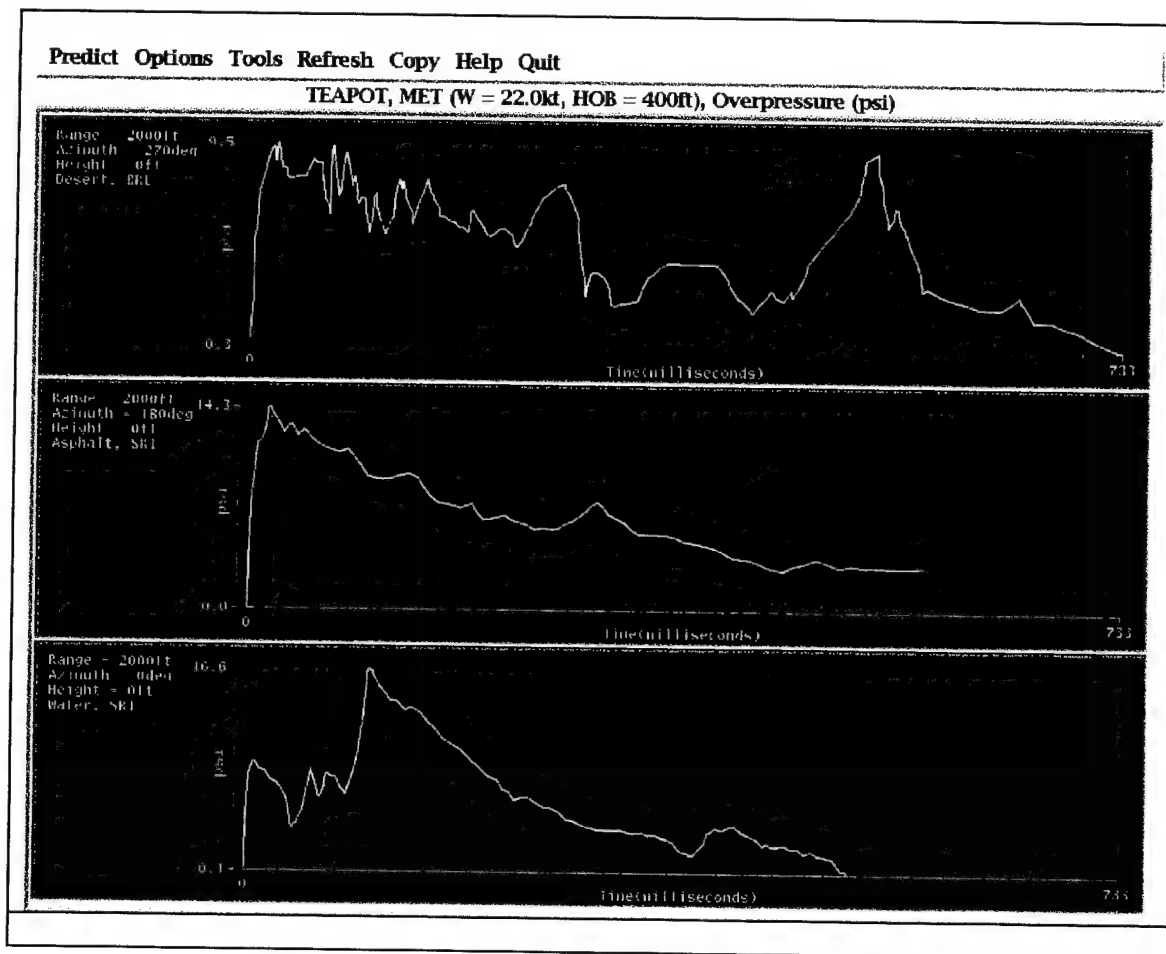


Figure 2-17. Data from three lines of Teapot/MET.

The application that displays pressure data also gives the user access to certain modeling capabilities. Once the user has selected a particular event, one can invoke models based on Brode (Brode 1986) and LAMB (S-Cubed 1983) that are computed in real time according to the parameters of the explosions that produced the selected waveforms. The user can adjust certain parameters of the modeling programs (yield in kilotons and height-of-burst in feet for the Brode model, and those parameters plus height-of-

instrument in feet for the LAMB model) via dialog boxes that appear when modeling is started. A sample of Brode (Brode 1986) computed pressure data overlaid on the observed data displayed above is shown in Figure 2-18.

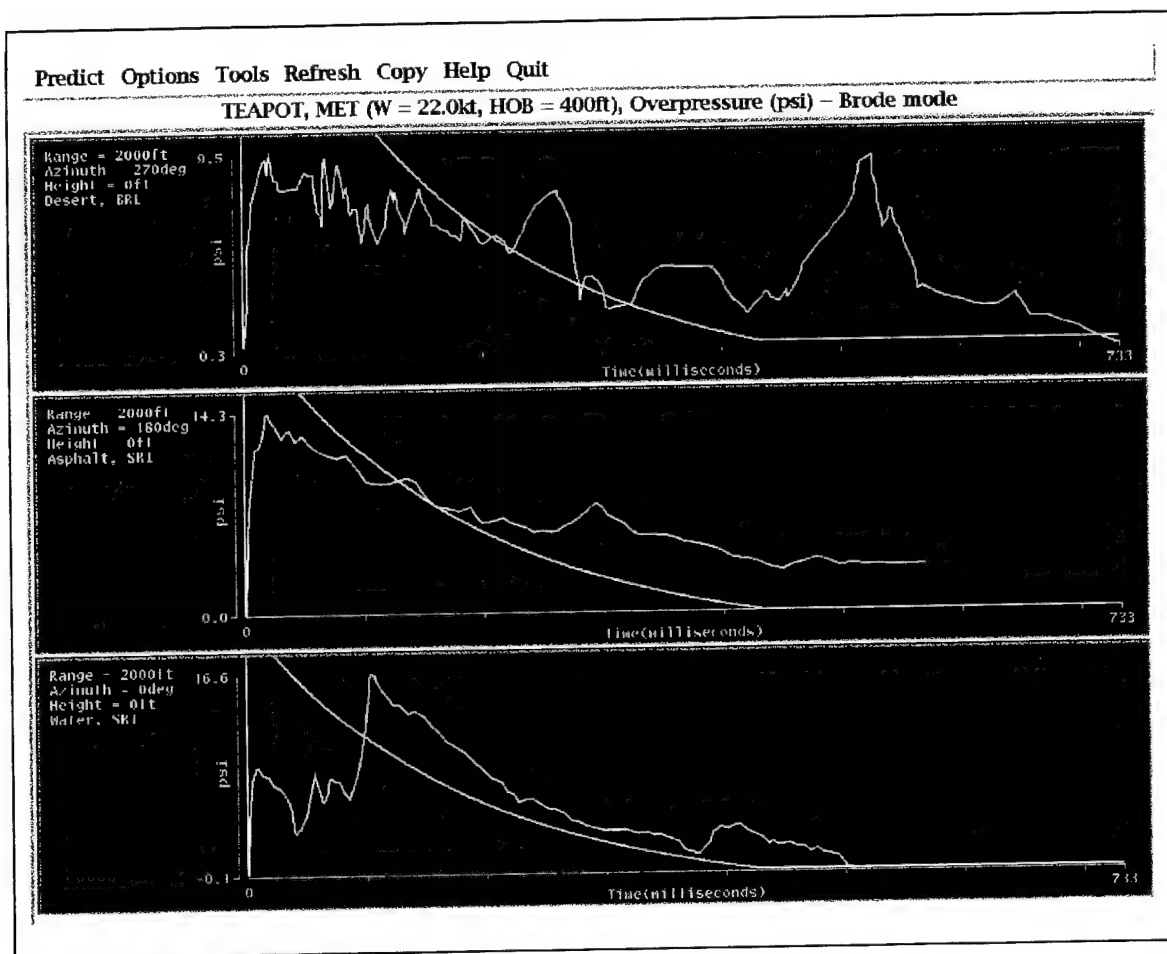


Figure 2-18. Data from Figure 2-17 with Brode modeling results overlaid.

Additionally, more elaborate calculated pressures developed for the series Plumbbob event Priscilla, from a detailed finite difference calculation carried out using the SHARC code (Needham et al. 1994), are available for overlay. These calculations were performed off-line. Figure 2-19 shows selected time series from Plumbbob event Priscilla with SHARC modeling results overlaid.

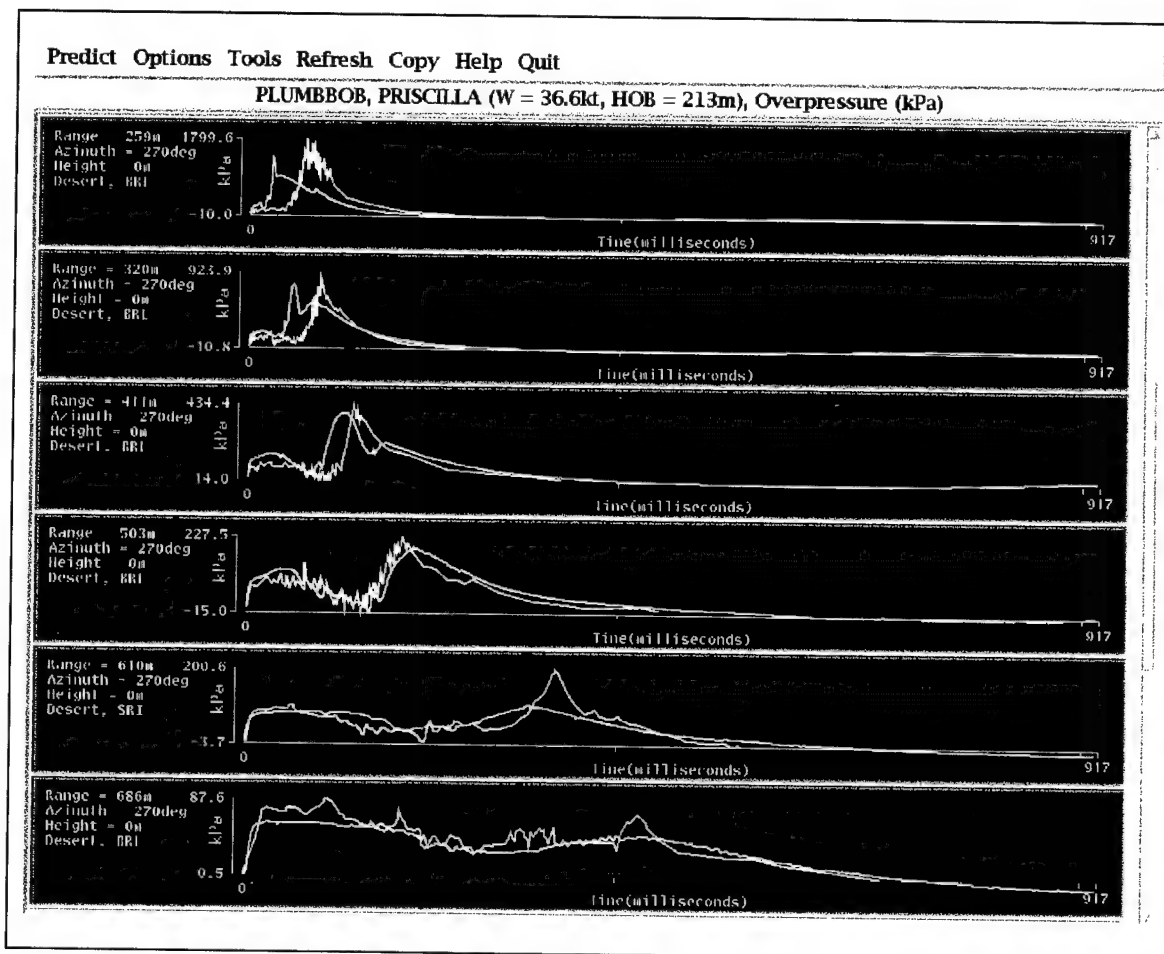


Figure 2-19. Data from Plumbbob event Priscilla with SHARC modeling results overlaid.

For comparison, Figure 2-20 shows the same time series shown before but with Brode (Brode 1986) modeling results overlaid. It is immediately apparent from a comparison of Figures 2-19 and 2-20 that the SHARC non-ideal airblast simulation provides a much better fit to these data than does the simplified Brode model.

Figures 2-19 and 2-20 also illustrate the capability of the time series display program to show data in SI units.

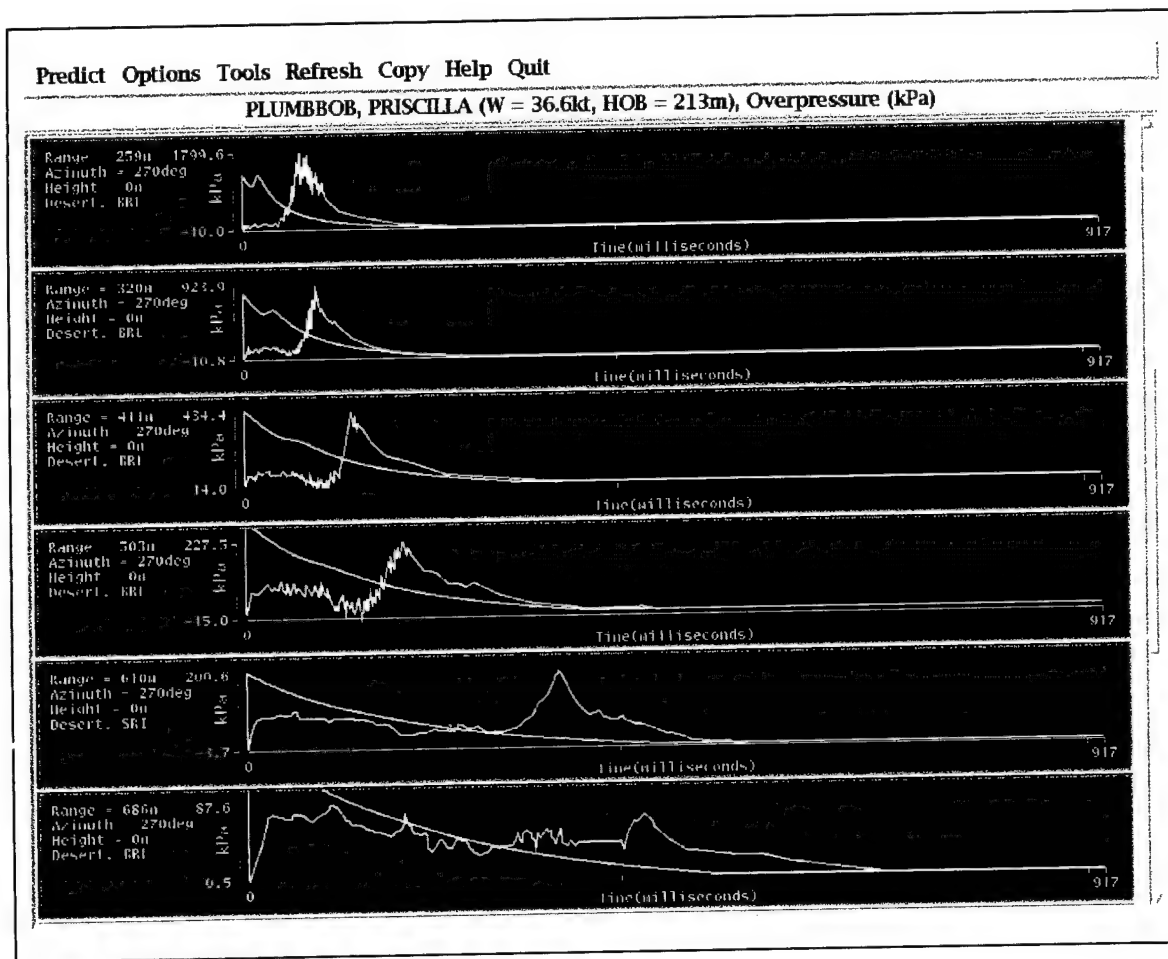


Figure 2-20. Data from Plumbbob event Priscilla with Brode modeling results overlaid.

Individual waveforms are not the only type of output from SHARC that is available for display within NEDMAS. Figure 2-21 shows the computed velocity vectors in air at a range of 475-725 m from the detonation point, 600 msec after the detonation. The complicated regions of airflow associated with the pressure front resulting from nuclear explosions can be seen clearly, particularly in the color display that is shown on the computer monitor.

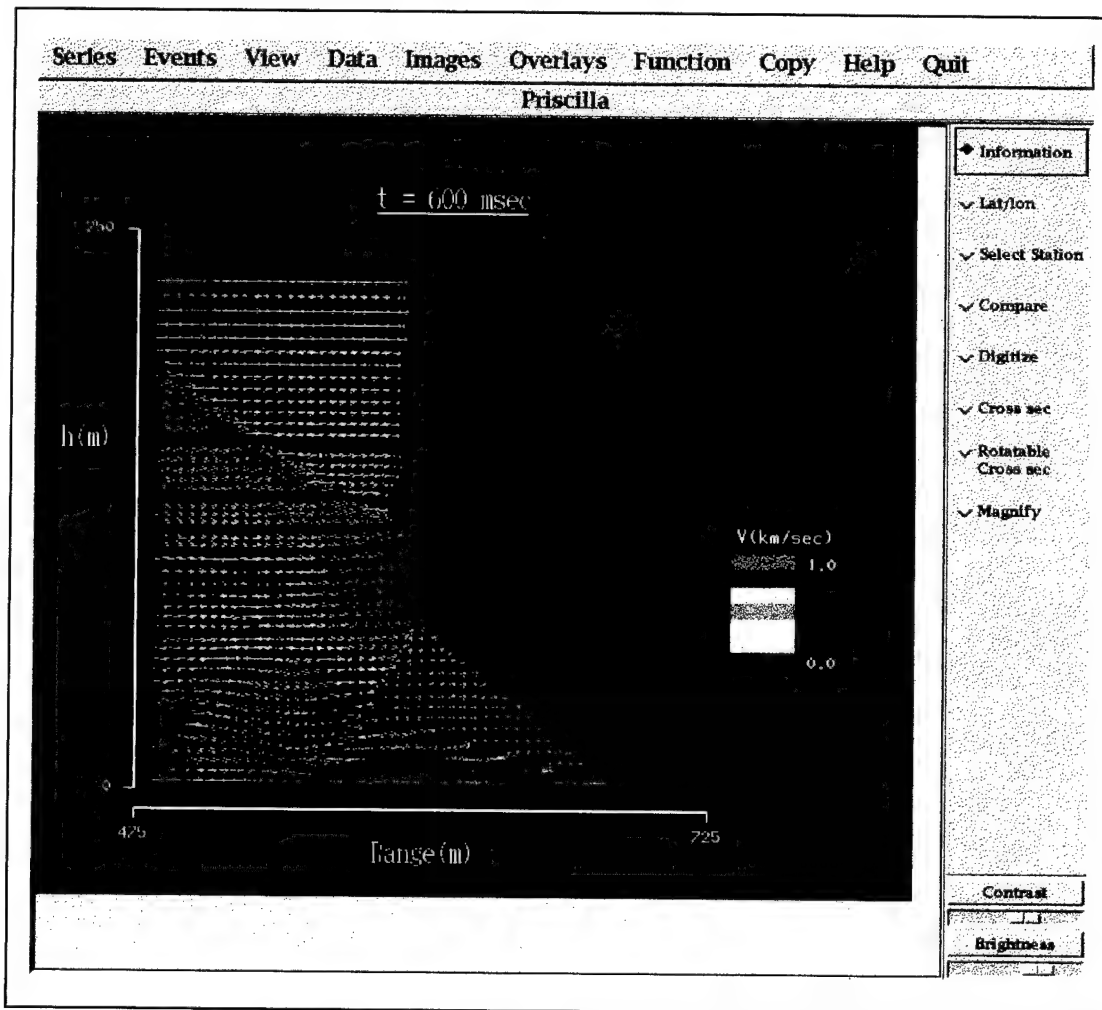


Figure 2-21. SHARC velocity vectors display.

Another method for comparing time series is available from the pressure plotting application. Given a display containing a suite of waveforms from a particular event, the selection of *Tools*⇒*Compare* and clicking on a particular waveform will bring up a dialog box of data from events in the database of similar scaled yield and range, where all numbers are scaled to a standard-sized explosion at a standard atmospheric pressure. One selects one or more matching events from the dialog box, which starts another copy of the waveform plotter showing waveforms from several events that match. This series of illustrations starts with Figure 2-22; it shows the instrument locations from series Plumbbob event Smoky, with several instruments at similar distances selected, as shown by colored diamonds overlaid on the instrument location icons.



Figure 2-22. Plumbbob/Smoky instrument locations for time series comparison.

Next, the time series recorded by these instruments is shown in Figure 2-23, so that the overpressures along different kinds of topography can be compared.

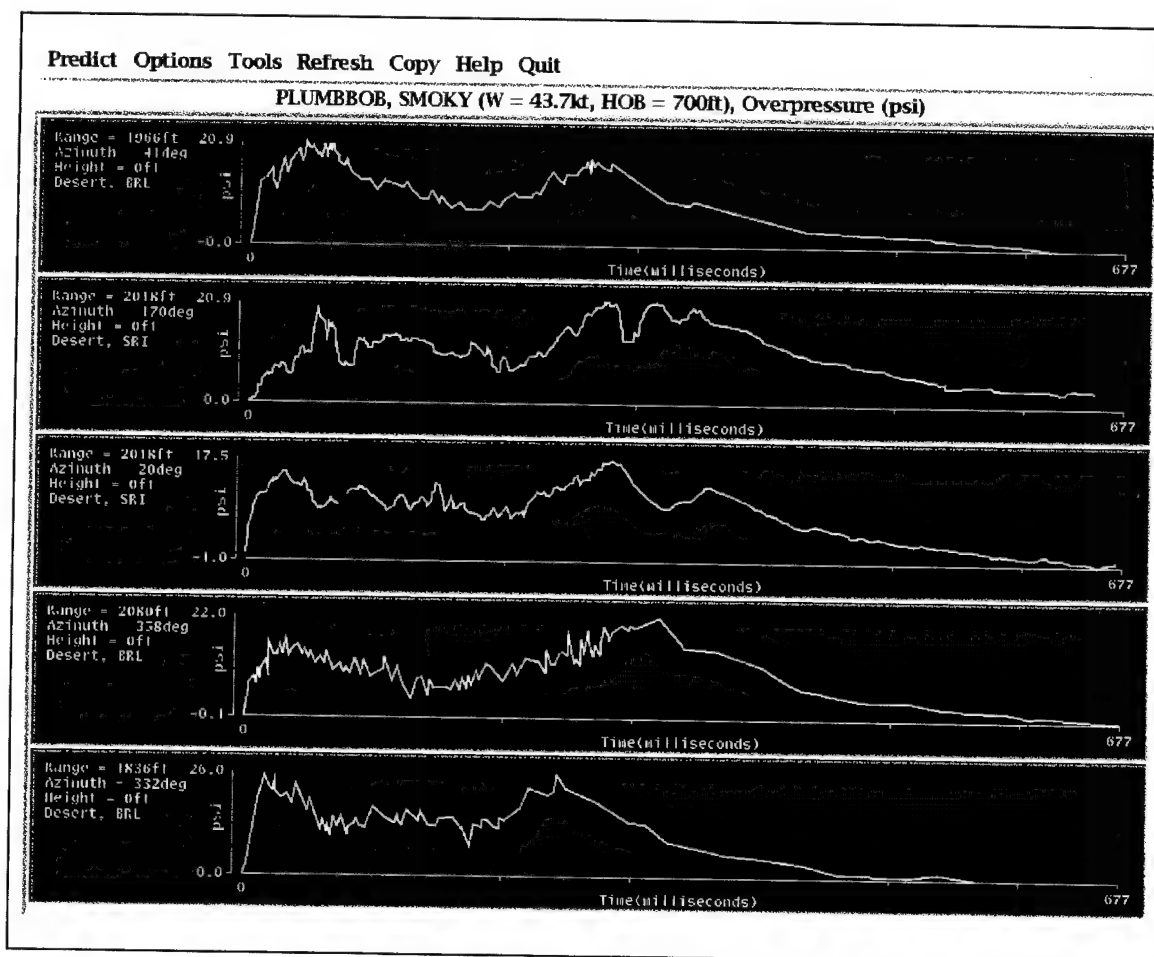


Figure 2-23. Data from selected instrument locations, Plumbbob/Smoky.

Finally, Figure 2-24 shows the third time series from Figure 2-23 compared to data from other events at similar scaled yields and distances.

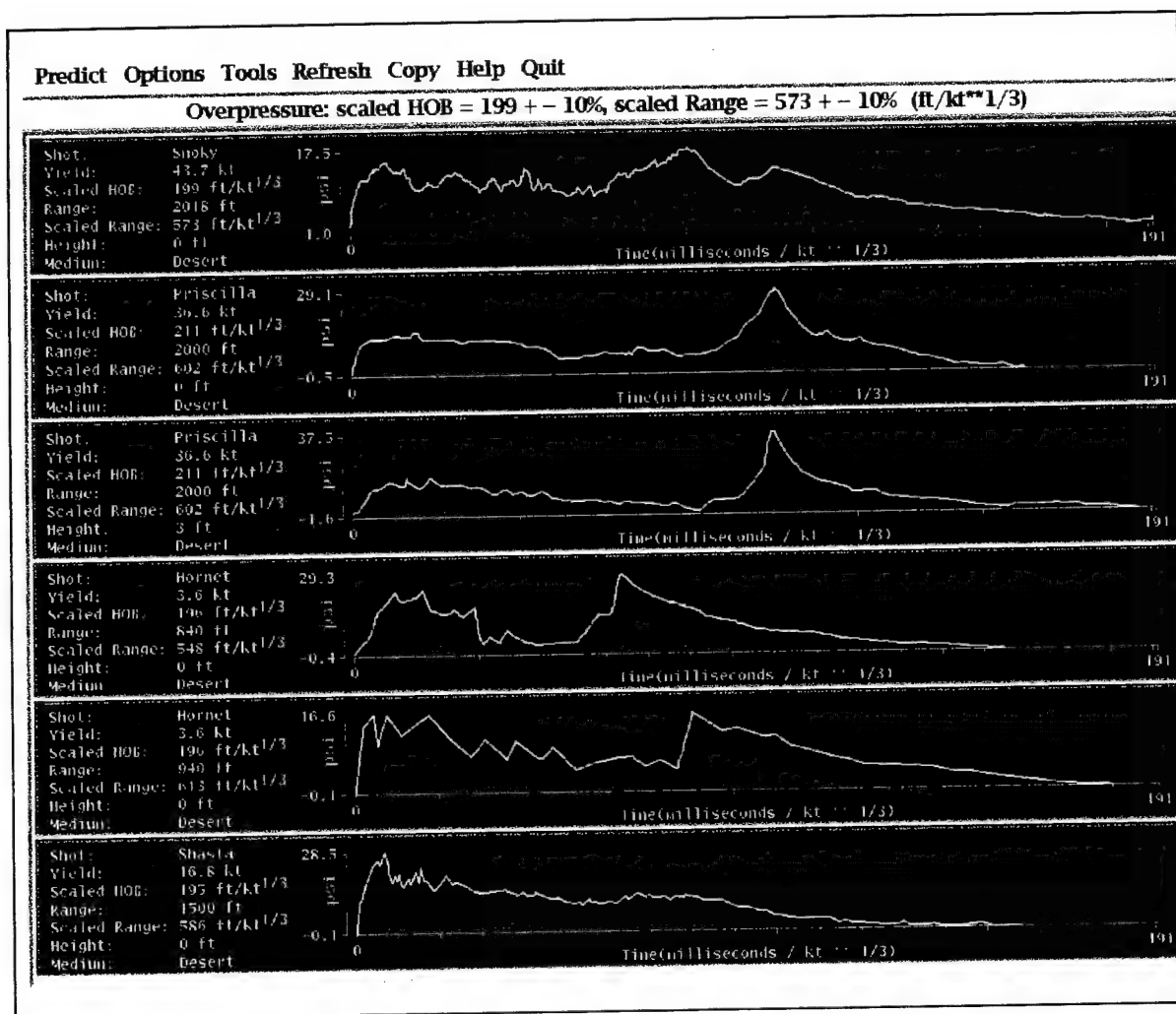


Figure 2-24. Time series from Plumbbob/Smoky compared to similar scaled events and instrument ranges.

Another method within NEDMAS for comparing data from different events is by the display shown in Figure 2-25. This shows, as background, pressure as a function of range and height-of-burst as calculated by the Brode model (Brode 1986) for a standard event yield and atmospheric pressure shown in color. On top of the background are shown color-coded boxes; each event occupies a horizontal line corresponding to its scaled height-of-burst, while the color in the box shows the scaled measured overpressure.

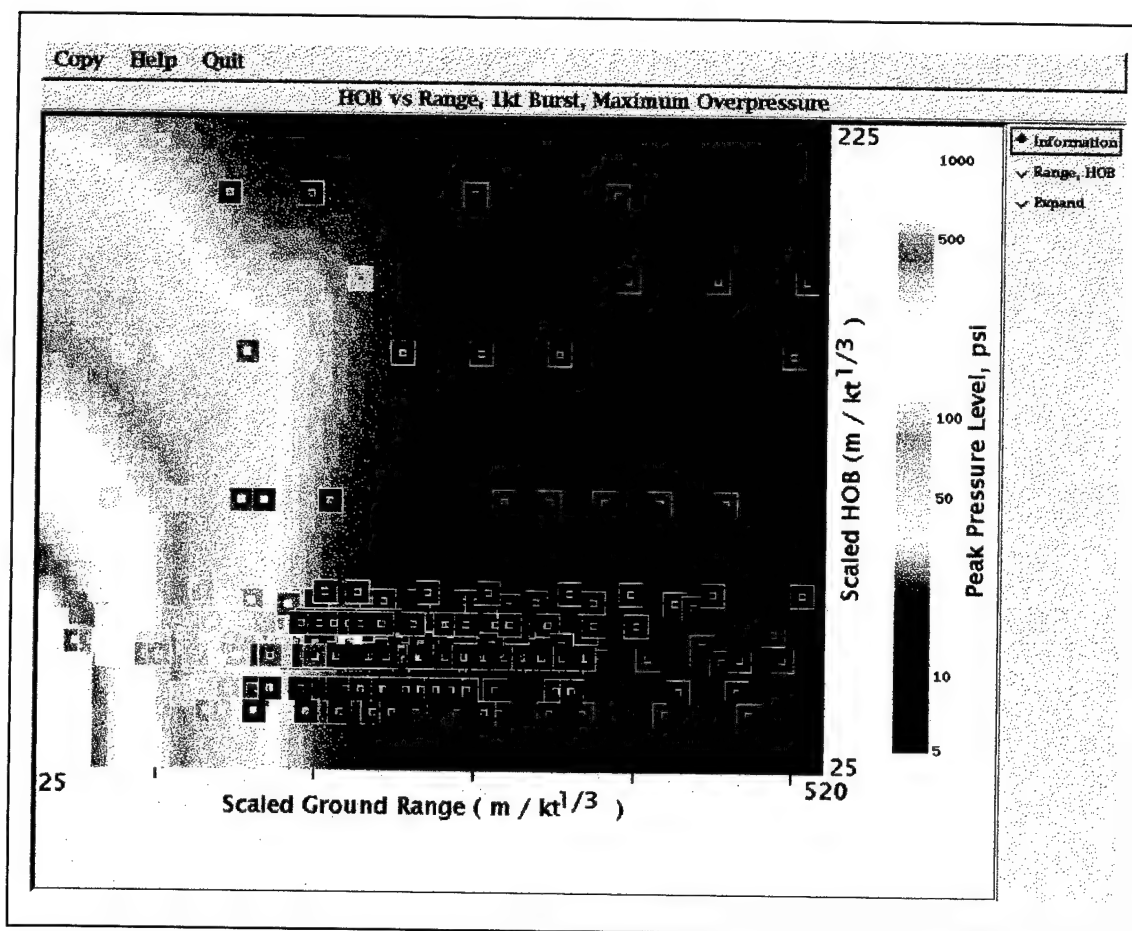


Figure 2-25. Scaled range versus scaled height-of-burst for all events.

SECTION 3

CONCLUSION

In this report we have presented an in-depth description of the research investigations directed toward the development of the Nuclear Effects Data Management and Analysis System. In its current configuration, NEDMAS is applicable to above-ground nuclear explosions at the U.S. Nevada Test Site and encompasses an online database of approximately 1000 pressure time series from 24 events in 3 series, as well as some preliminary fireball photography, cratering data, and ground motion data. Total data volume at the time of this report is about 6 MB. Information regarding the explosion source environment is presented to the analyst in the context of a SPOT® satellite image of the site surrounding the detonation point, together with associated surface geologic information and DMA topographic data.

The capabilities and functionality of NEDMAS were illustrated in Section 2 using displays of the screens encountered by an analyst in a typical processing session. The selected capabilities displayed in this sample session were related to a more complete definition of the system functionality through references to a series of appendices containing a detailed script of the user actions required to reproduce the sample session (Appendix B); a complete description of all currently-available system options (Appendix C); and information regarding software and hardware implementation requirements (Appendix A). Taken together, Section 2 and its associated appendices provide a concise description of the results of the NEDMAS development effort.

Under an ongoing follow-on effort, Maxwell Technologies Inc. is continuing the development of the NEDMAS nuclear effects software system with the primary objective of integrating it into the new comprehensive DSWA DARE archival database of reports, photos, test data, and films related to nuclear weapons effects. More specifically, this effort is being used to develop generally applicable procedures and software that will facilitate the implementation of other user application interfaces to DARE. A prototype version of NEDMAS has recently been installed on the operational version of DARE running at the DSWA headquarters computer center and is currently accessible to DARE users having UNIX workstations.

SECTION 4

REFERENCES

Brode, H (1986). "Airblast from Nuclear Bursts - Analytic Approximations". Pacific Sierra Research Corporation, Report 1419-1, September 1986.

Murphy, J.R., B.W. Barker, and D. O'Neill (1995). "Nuclear Effects Data Management and Analysis System (NEDMAS), Technical Proposal", S-Cubed Proposal No. SSS-P-96-8620407, Solicitation No. DNA001-95-R-0063, prepared for Headquarters Defense Nuclear Agency, 8 December 1995.

Needham, C.E., R.G. Ekler, and L.W. Kennedy (1994). "Extended Desert Calculation Results with Comparisons to PRISCILLA Experimental Data and a Near-ideal Calculation," S-Cubed report SSS-DTR-94-14802.

S-Cubed (1983). "LAMB: Single Burst Model". S-Cubed report S-Cubed 84-6402.

S-Cubed (1994). "Nuclear Effects Data Management and Analysis System (NEDMAS)". Presentation at Defense Nuclear Agency Radiation Sciences Simulation and Modeling Conference, Williamsburg, Virginia, November 1994.

APPENDIX A

REQUIREMENTS AND STARTUP INSTRUCTIONS

A.1 HARDWARE REQUIREMENTS.

NEDMAS was developed initially on Sun SPARCStations running SunOS 4.1.x, then was moved to SunOS 5.x, also known as Solaris 2. The current version runs on a SPARCStation 20 under Solaris 2.5. The machines used to develop the system all had a minimum of 32MB of resident memory. NEDMAS uses the standard Sun 8-bit color monitor with a resolution of 1152x900 pixels and also uses the standard Sun three-button mouse. As currently configured, NEDMAS occupies about 500 MB of hard disk space. When run over a network, it has run successfully on several vintages of Sun computers as well as a standard Windows 95 computer with a screen large enough to display the application and a commercial X server.

A.2 SOFTWARE REQUIREMENTS.

NEDMAS is written in C and FORTRAN and uses the X Window System version 11 release 5 and the Motif release 1.2 widget set. It has been compiled successfully using the GNU C/C++ compiler, versions 2.5 and later, and the Sun FORTRAN compiler. Without special modification, NEDMAS has been run over the World Wide Web via a set of CGI scripts under Netscape Navigator 2.0 and later.

A.3 STARTUP INSTRUCTIONS.

The procedure used to launch NEDMAS varies somewhat according to the platform being used. Platforms available at the time of this report are a UNIX workstation running the X Windows system, both on a local machine and over a network; and a World Wide Web-style browser on a machine with X Windows capability connected to a UNIX workstation. Whichever launching path is applicable to a particular installation, the first NEDMAS display you will see will be a title page.

NEDMAS can be launched with an optional demonstration script on the screen, as shown in Appendix B, Figure B-1. To launch that version, substitute the command *nedmas_script* for the command *nedmas* as shown below.

To launch NEDMAS on a UNIX workstation running X Windows, displaying on the same machine:

1. change directory to the NEDMAS home directory.
2. execute the initialization script "Init" under the C-Shell.
3. launch the application.

Example:

Assume NEDMAS resides in a directory called "/data/d/NEDMAS".

```
prompt> cd /data/d/NEDMAS
prompt> source Init
prompt> nedmas & (or nedmas_script & for scripted version)
```

To launch NEDMAS on a remote UNIX workstation running X Windows, but displayed on a local machine:

1. open a terminal window on the local machine.
2. command the local machine to permit remote machines to display X Windows output.
3. login to the remote machine on which NEDMAS will be executed.
4. on the remote machine, change directory to the NEDMAS home directory.
5. on the remote machine, execute the initialization script "Init" under the C-Shell.
6. inform the remote machine that X Windows output is to be displayed on the local computer.
7. launch the application.

Example:

Assume LosAngeles is the name of the remote computer on which NEDMAS will run and that NewYork is the local machine on which X Windows will display application output. As before, NEDMAS resides in "/data/d/NEDMAS". Prompts on the two machines are indicated by the machine name followed by a ">".

on NewYork: launch an xterm

```
NewYork> xhost +
NewYork> telnet LosAngeles
Trying 123.456.78.90...
Connected to LosAngeles.
Escape character is '^]'.
```

SunOS UNIX (LosAngeles)

```
login: myname
Password: *****
Last login: ... [more output from remote computer
LosAngeles]
```

```
LosAngeles> cd /data/d/NEDMAS
LosAngeles> source Init
LosAngeles> setenv DISPLAY NewYork:0.0
LosAngeles> nedmas & (or nedmas_script & for scripted version)
```

To launch NEDMAS via a World Wide Web-style browser on a machine with X Windows capability connected to a UNIX workstation:

1. launch a web browser application on the local machine.
2. connect to the web server that hosts NEDMAS and navigate to the NEDMAS homepage.
3. optionally, look at an overview of NEDMAS by selecting the hyperlink *An Overview of NEDMAS*.
4. follow the instructions on the webpage to launch NEDMAS. Both scripted and normal versions are available.

A.4 SHUTDOWN INSTRUCTIONS.

To shut down NEDMAS:

- Choose Quit from the main menu of all open NEDMAS applications.
- If running under X over a network, the user can shut down X. The precise details vary according to local convention, but generically are as follows:
 - ◊ Point to the "desktop" (i.e., outside any application window) and press the mouse button that brings up the system control menu; this often is the left mouse button.
 - ◊ Move the pointer to the menu item *Exit X Windows*, stop, then move the pointer to the right onto the item *Select If You're Sure* and release the mouse button.
- If running via a World Wide Web browser, select *Exit* from the *File* menu of the browser to terminate execution of the browser.

APPENDIX B

A SAMPLE SESSION WITH NEDMAS

In this appendix, we present a script listing the actions necessary to duplicate a sample session with NEDMAS.

One feature of NEDMAS is its ability to display an on-screen demo script to allow the neophyte user to become familiar with the application. Figure B-1 shows the NEDMAS display with the on-screen script showing. The user scrolls down the script while working through the application. The text appearing below is the text of the online demonstration script.

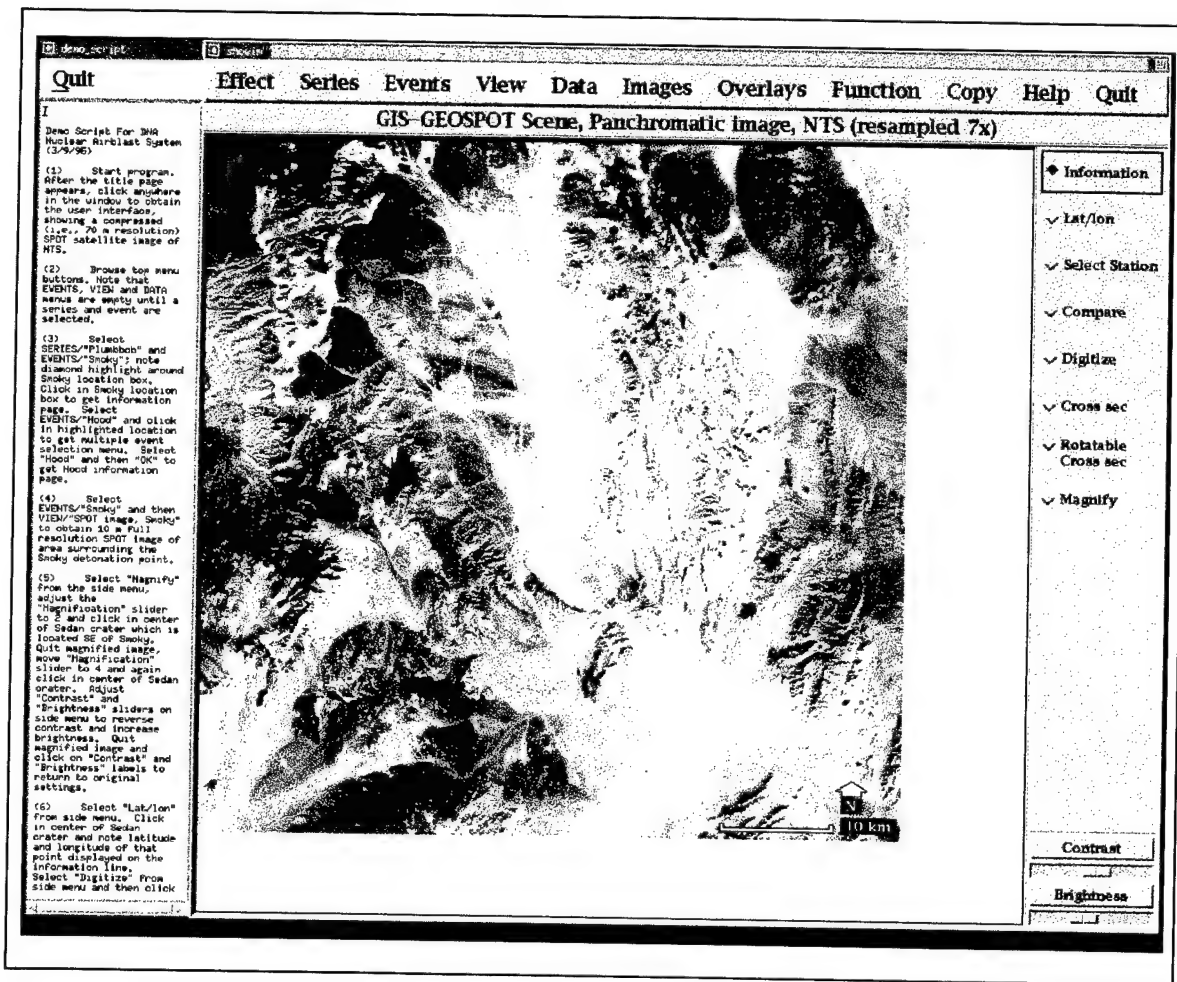


Figure B-1. NEDMAS startup screen and on-screen script.

Screen displays resulting from the actions described here appear in Section 2.

- (1) Start program. After the title page appears, click anywhere in the window to obtain the user interface, showing a compressed (i.e., 70 m resolution) SPOT® satellite image of NTS.

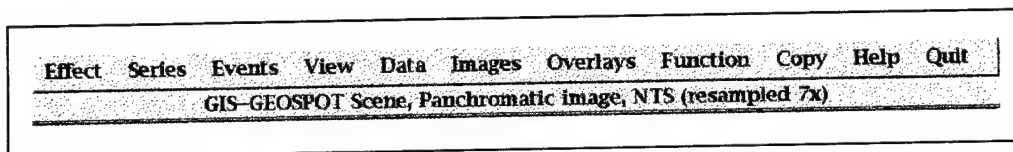


Figure B-2. Main menu and information line.

- (2) Browse top menu buttons. Note that EVENTS, VIEW and DATA menus are empty until a series and event are selected.
- (3) Select EFFECT/"Airblast", SERIES/"Plumbbob" and EVENTS/"Smoky"; note diamond highlight around Smoky location box. Click in Smoky location box to get information page. Select EVENTS/"Hood" and click in highlighted location to get multiple event selection menu. Select "Hood" and then "OK" to get Hood information page.

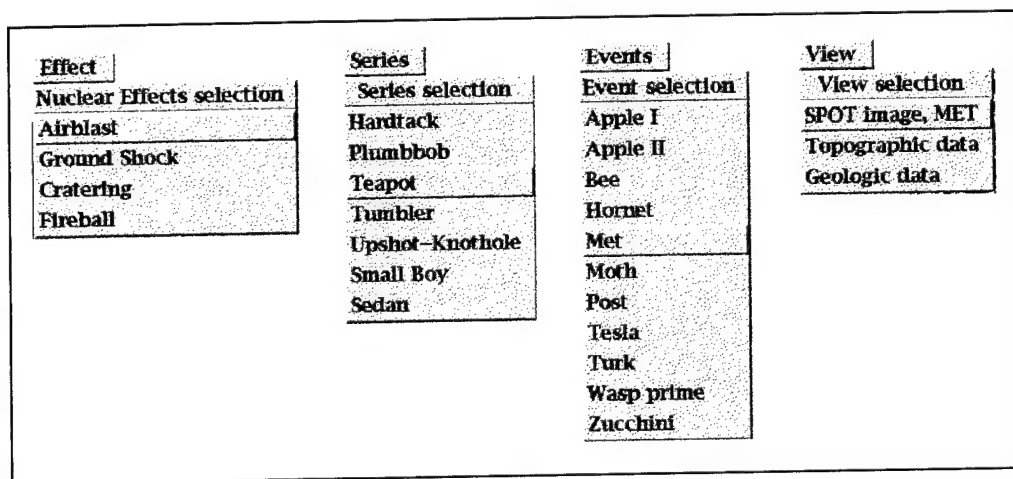


Figure B-3. Sample Effect, Series, Events, and View menus.

- (4) Select EVENTS/"Smoky" and then VIEW/"SPOT® image, Smoky" to obtain 10 m full resolution SPOT® image of area surrounding the Smoky detonation point.

- (5) Select "Magnify" from the side menu, adjust the "Magnification" slider to 2 and click in center of Sedan crater which is located SE of Smoky. Quit magnified image, move "Magnification" slider to 4 and again click in center of Sedan crater. Adjust "Contrast" and "Brightness" sliders on side menu to reverse contrast and increase brightness. Quit magnified image and click on "Contrast" and "Brightness" labels to return to original settings.

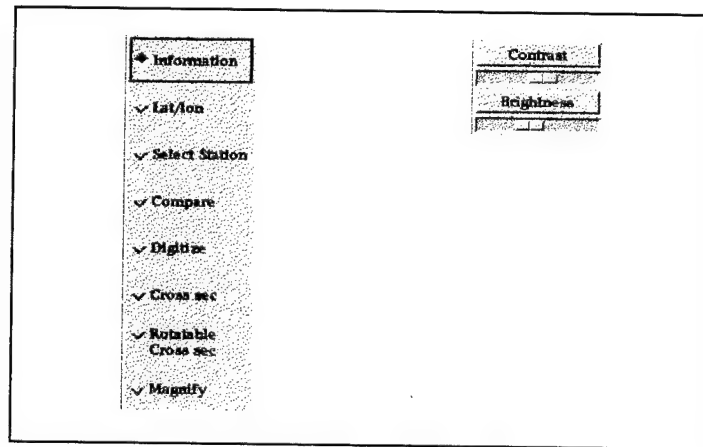


Figure B-4. Side menu and Contrast/Brightness controls.

- (6) Select "Lat/lon" from side menu. Click in center of Sedan crater and note latitude and longitude of that point displayed on the information line. Select "Digitize" from side menu and then click sequentially on a few points representing a closed outline boundary of Sedan crater. Select OVERLAYS/"Digitized overlays"/"Current" to overlay the digitized crater outline. Select FUNCTION/"Save overlay" and move the cursor into the entry line of the dialog box. Type Sedan_Crater and then "Cancel" the box without saving. Select VIEW/"Geologic data" and then OVERLAYS/"Digitized overlays"/"Current" to show outline of Sedan crater on geologic map of NTS.

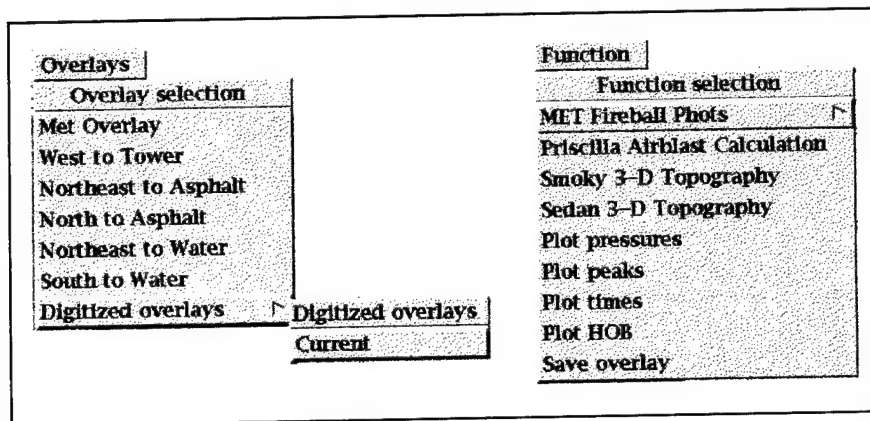


Figure B-5. Sample overlays menu with submenu and Function menu.

- (7) Select VIEW/"Spot image, Smoky" and then DATA/ "Overpressure" to overlay Smoky overpressure instrument locations on the SPOT® image. Select IMAGES/"Smoky detonation," IMAGES/"Aerial photos"/North to tower,".../"Southeast to tower." Select IMAGES/"Instrumentation"/"Overpressure gage assembly, ".../"Dynamic pressure gage installations."

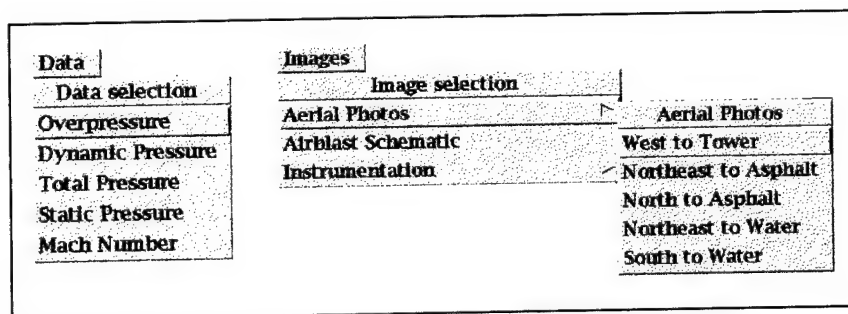


Figure B-6. Sample Data menu and Images menu with submenu.

- (8) Select VIEW/"Topographic data" to show color-coded topographic image of the Smoky site. Select OVERLAYS/"Digitized overlays"/"Current" to outline Sedan crater location. Select "Cross sec" from side menu and sequentially click on point south of Sedan crater and on point north of crater. Quit the cross-section display. Select "Rotatable Cross sec" from side menu and sequentially click on point in center of crater and on point north of crater. Quit the cross-section display and move the "Xsec Rotation" slider to 90 to obtain EW profile through crater. Quit

the cross-section display. Select "3-D Topography" from the FUNCTIONS menu. Click on "Cycle" button. Dismiss viewing angle pop-up window. Select VIEW/"Topographic data." Select "cross sec" from side menu and sequentially click on a point SE of the event location and on a point in the region of high topography along the trend of the NW instrumentation line. Click on box at top of tower and note Smoky event information displayed on information line. Quit the cross-section display.

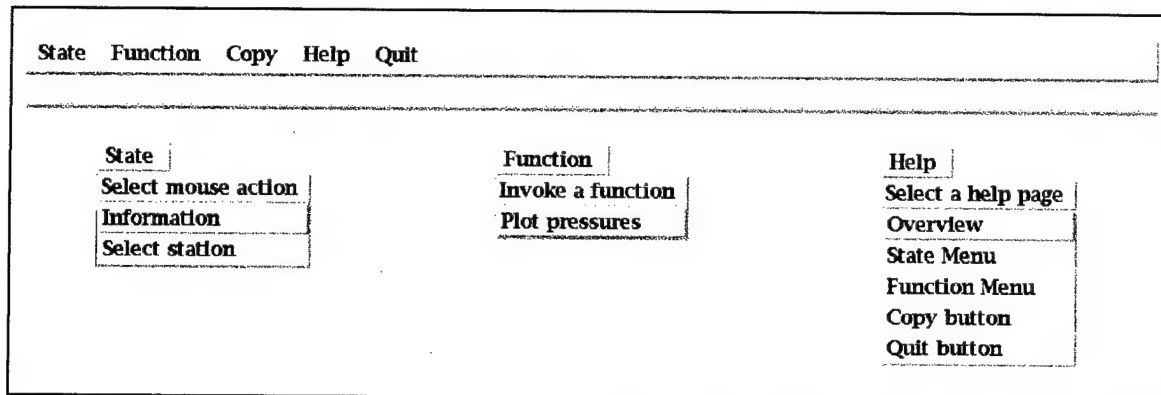


Figure B-7. Crosssec main menu, message line, and pulldown menus.

- (9) Sequentially click on a point west of the event location and on a point beyond the last station on the eastern most (NE) line. Select STATE/"Select station" from cross-section menu and click once on a station location to view station data on the information line. Click twice on each station location to select for display. Select FUNCTION/"Plot pressures" from cross-section menu to obtain an Analyst Station display of the selected station overpressure waveforms. Scroll through waveforms.

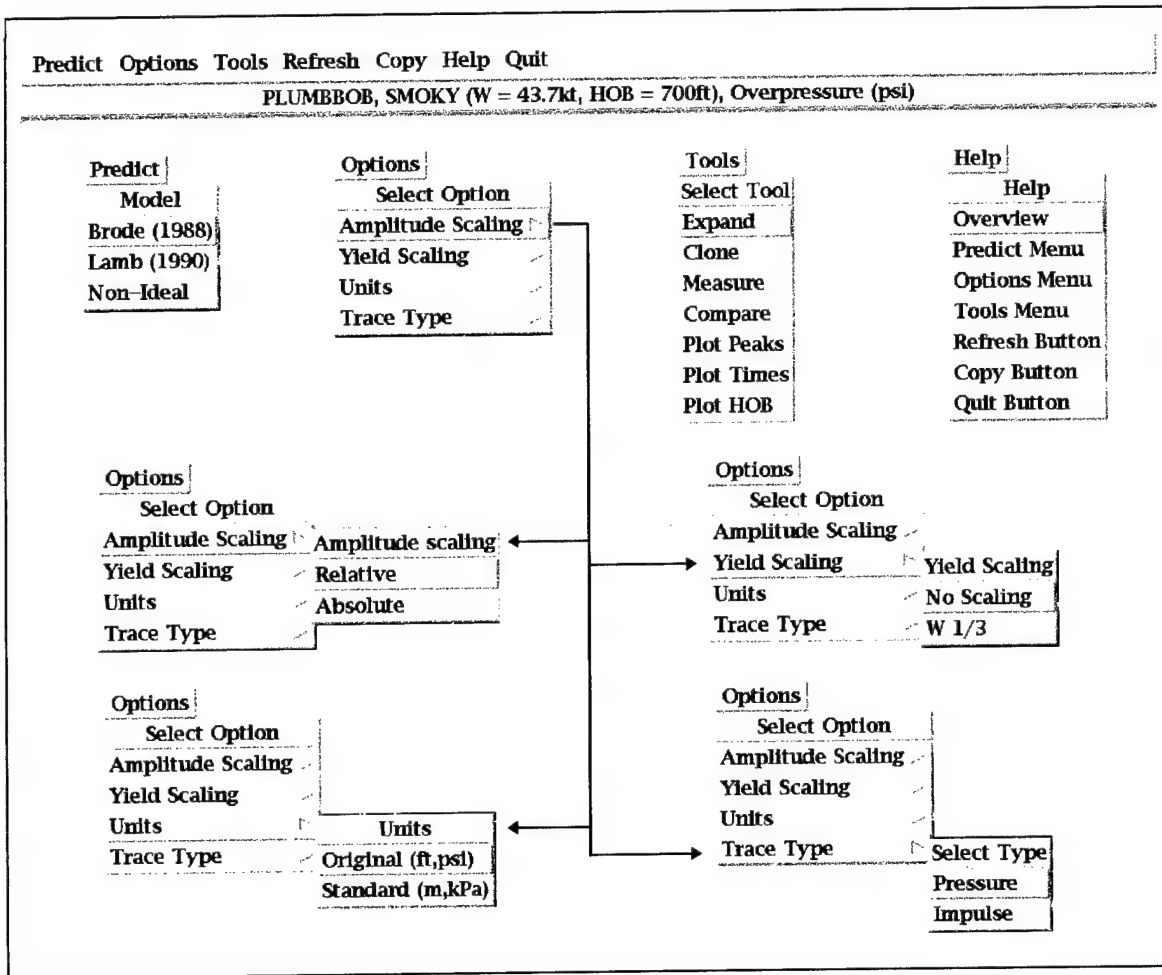


Figure B-8. Analyst Station main menu, message area, and pull-down menus.

- (10) Select OPTIONS/"Units"/"Standard (m,kPa)" from Analyst Station menu to convert display units from ft/psi to m/kPa. Select OPTIONS/ "Amplitude Scaling"/"Absolute" to convert all displays to the same amplitude scale. Select OPTIONS/"Yield Scaling"/"W 1/3" to cube root scale the data to 1 kt at sea level in a standard atmosphere. Select OPTIONS/"Trace type"/"Impulse" to convert overpressure waveforms to impulse versus time. Select OPTIONS/"Trace Type"/"Pressure" to replot original overpressure waveforms.
- (11) Select TOOLS/"Expand" and click on any trace to view expanded waveform. Select TOOLS/ "Measure" and click on any point on the expanded trace and note the corresponding time and amplitude values displayed on the information line. Select PREDICT/"Brode" and click on "Apply" button in Brode dialog box to overlay Brode prediction on observed waveform. Move the Brode yield slider to 30 kt and "Apply." Select PREDICT/"Lamb," move Lamb slider to 30 kt and

"Apply." Quit the expanded waveform display to return to the original Analyst Station display. Select PREDICT/"Brode," move yield slider to 30 kt and "Apply." Scroll through waveforms to compare predicted and observed. Quit Analyst Station and then Quit cross-section display to return to main menu.

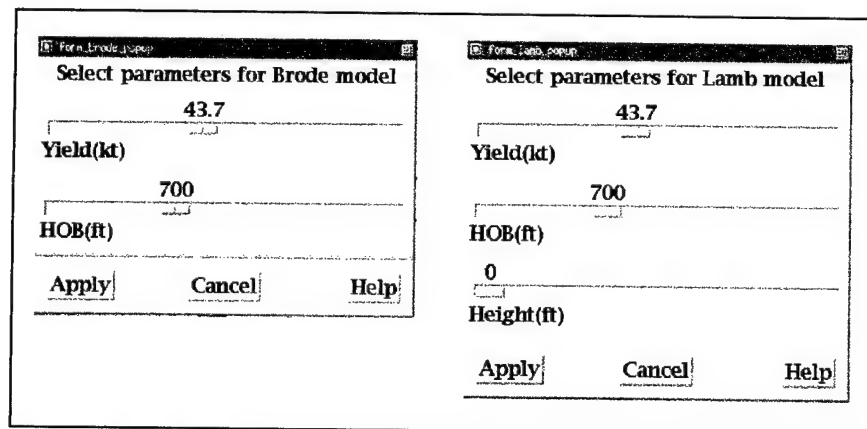


Figure B-9. Sample Brode and LAMB control dialog boxes.

- (12) Select FUNCTION/"Plot peaks" to view reported Smoky overpressure peaks versus range. Click on one of the peak amplitude boxes to get information about that data point. Quit the peak display and select FUNCTION/"Plot times" to view Smoky overpressure arrival times versus range. Quit arrival time display.

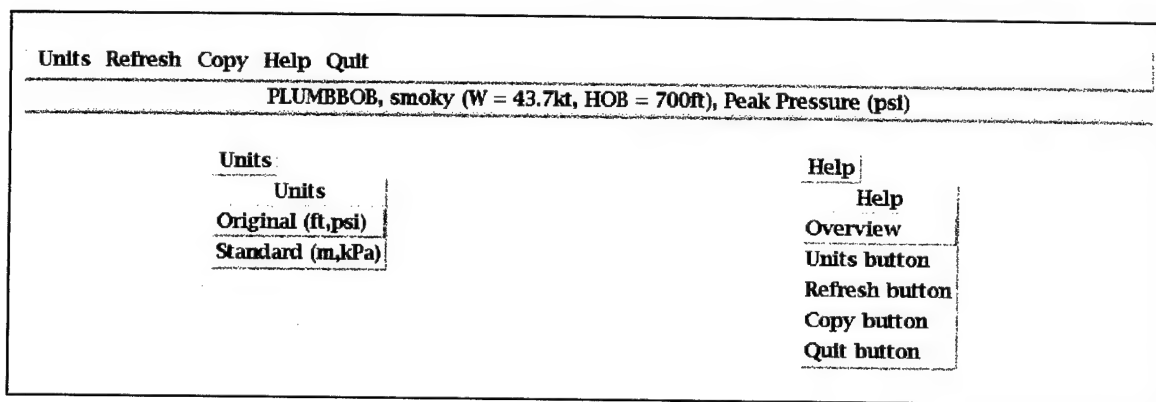


Figure B-10. PlotPeaks and PlotTimes main menu, message line, and pulldown menus.

- (13) Select VIEW/"SPOT image, Smoky" and side menu "Compare." Click twice on first station on E(NE) line and note how stations at same distance on other lines

are highlighted. Select FUNCTION/"Plot pressures" and then OPTIONS/"Amplitude Scaling"/"Absolute." Select TOOLS/"Clone" and click on the first trace. Move the cursor down the page until the color-coded clone overlays another trace for comparison. Click to dismiss clone. Select PREDICT/"Brode," move yield slider to 30 kt and "Apply." Select TOOLS/"Compare" and click once on trace measured at azimuth of 20 degrees to obtain a pop-up window listing all waveforms in the database measured at comparable scaled distances from comparable scaled HOB explosions. Click on all non-Smoky lines in the display and select "OK" to obtain Analyst Station plot showing selected Smoky trace (scaled to 1 kt) at top and scaled versions of other selected traces below it. Select OPTIONS/"Amplitude Scaling"/"Absolute." Select TOOLS/"Clone" and overlay copy of first trace on others. Select PREDICT/"Brode" and "Apply" to compare 1 kt Brode prediction with the displayed scaled data. Sequentially "Quit" the two Analyst Station displays to return to the main menu.

- (14) Select EVENTS/"Priscilla" and IMAGES/"Priscilla detonation." Select IMAGES/"Aerial Photos"/"Before test, low elevation." Select OVERLAYS/"Before test, low elevation" to identify test structure locations. Repeat for other Priscilla aerial photos.
- (15) Select VIEW/"SPOT image, Priscilla" and DATA/"Overpressure." Select "Cross sec" from side menu and sequentially click on a point east of the event and on a point at the west end of the instrumentation line. Click on balloon basket to access Priscilla event data on the information line. Select STATE/"Select Station" from cross-section menu and click twice on each station location box. Select FUNCTION/"Plot pressures" from cross-section menu to obtain Analyst Station display of the selected station overpressure waveforms.
- (16) Select PREDICT/"Brode" and click on "Apply" button in Brode dialog box to overlay Brode predictions on observed waveforms. Scroll through waveforms. Select REFRESH. Iconify Analyst Station window and "Quit" the cross-section display. Select IMAGES/"Airblast Schematic." De-iconify Analyst Station. Select PREDICT/"Non-Ideal" to overlay finite difference predictions on observed waveforms. Scroll through waveforms. "Quit" the Analyst Station display.
- (17) Select FUNCTION/"Priscilla Airblast Calculation." Select "Cycle" from dialog box. Move cursor to frame 8. Select OVERLAY/"Non-Ideal Airblast Schematic." Dismiss dialog box.
- (18) Select SERIES/"Teapot" and EVENTS/"Wasp Prime." Sequentially click on points north and south of highlighted Wasp Prime location. Click on box next to the plane symbol to view event information. Quit the crosssection display.

- (19) Select EVENTS/"Met" and VIEW/"SPOT image, Met." Select DATA/"Overpressure" and OVERLAYS/"Met overlay." Select IMAGES/"Aerial photos"/"West to tower" and OVERLAYS/"West to tower." Repeat for other Met aerial photos. Select VIEW/"SPOT image, Met." Select side menu "Compare" and click twice on the fourth desert line station (2000 ft). Select FUNCTION/"Plot pressures" and then OPTIONS/"Amplitude Scaling"/"Absolute." Select TOOLS/"Clone" and overlay the first (i.e. desert) trace on the other two (water and asphalt). Select PREDICT/"Brode" and "Apply." Quit Analyst Station display.
- (20) Select SERIES/"Plumbbob" and EVENTS/"Hood." Select "Cross sec" from side menu and sequentially click on points north and south of the Hood location. Click on balloon baskets to get event information. Quit the cross-section display. Select VIEW/"SPOT image, Hood" to see present day collapse craters around Hood location on Yucca Flat.
- (21) Select EVENTS/"Franklin" and VIEW/"SPOT image, Franklin." Select DATA/"Overpressure" and then sequentially click on a point west of Franklin location and on a point at the east end of the instrumentation line. Select STATE/"Select station" and click twice on closest station. Select FUNCTION/"Plot pressures" and then select PREDICT/"Lamb" and "Apply." Move Lamb instrument height slider to 10 ft and "Apply" to illustrate incorporation of surface reflected phase in the LAMB code. Quit the Analyst Station and Cross-section displays to return to the main menu.
- (22) Select SERIES/"Teapot" and IMAGES/"Detonations" and cycle through the detonation photos. Select FUNCTION/"Plot peaks" and cycle through the peak pressure plots. Cancel event selection dialog box. Repeat for "Plot times" and "Cancel" event selection dialog box. Select FUNCTION/"Plot HOB" and click on box to view information regarding that data point.
- (23) Select FUNCTION/"MET Fireball Photos"/"Camera 1". Select "Cycle" from dialog box. Dismiss dialog box. Repeat for "Camera 2."
- (24) Select "Quit" from main menu to terminate program.

APPENDIX C

A COMPREHENSIVE REFERENCE TO NEDMAS FUNCTIONALITY

In this section, the capabilities and functionality of the Nuclear Effects Database Management and Analysis System (NEDMAS) will be described, with samples of displays encountered by a user. A detailed script of the user actions necessary to reproduce the sample screens is included as Appendix B.

C.1 GENERAL LAYOUT OF NEDMAS APPLICATIONS.

All applications that are part of NEDMAS have similar appearance. The parts of the displays used are as follows:

- menu bar - an area at the top of the display that contains buttons that cause menus to be displayed
- message area - a strip just under the menu bar that displays short messages from the application
- image area - the main display area of an application
- side menu area - an area to the right of the image area that contains switches to control the functionality of the mouse. When a particular mouse function is selected, an indicator is illuminated next to the name of the function.

These areas are illustrated in Figure C-1. Some NEDMAS applications do not contain all areas.

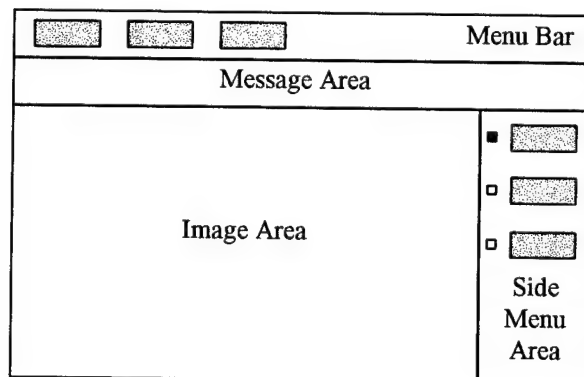


Figure C-1. General layout of NEDMAS applications

In addition to the areas described above, some actions cause dialog boxes to appear on the screen. A dialog box is a temporary window opened by the application to communicate information or to request input. Typically, the user responds to a dialog box by moving a slider or typing text into an input area, then tells the application to proceed by pressing an acceptance button, or to cancel the operation by pressing a cancel

button. Some dialog boxes also have associated help text that describes the function of the dialog box and the nature of the requested input. Dialog boxes disappear when dismissed.

C.2 THE MAIN IMAGE DISPLAY APPLICATION.

The main user interface of the NEDMAS application is through an image-display application. The layout of this application follows the pattern shown in figure C-1. This module provides the mechanism by which much of the general information provided by NEDMAS is presented to the user.

C.2.1 The Menu Bar.

The menu bar of NEDMAS contains several buttons, most of which cause menus to be displayed. The menu buttons are labeled *Effect*, *Series*, *Events*, *View*, *Data*, *Images*, *Overlays*, *Function*, *Copy*, *Help*, and *Quit*. The *Events*, *View*, *Data*, and *Images* menus are context-sensitive; that is, they contain data relevant to the current state of the application. Figure C-2 illustrates the menu bar.

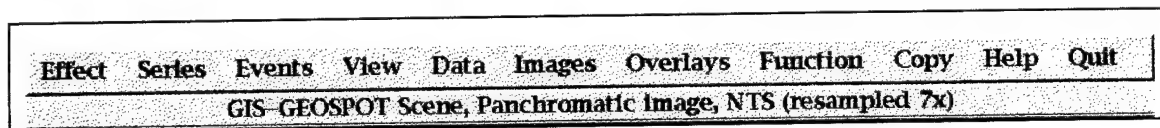


Figure C-2. The Main Image Display (MID) main menu and message area.

The **Effect menu** will give the user the ability to limit the type of data that will be accessed. When fully implemented, it will cause downstream menus, for example the Series Menu, to show only those series, events, and so on that contain data of the desired effect type. Figure C-3 shows the *Effect* menu.

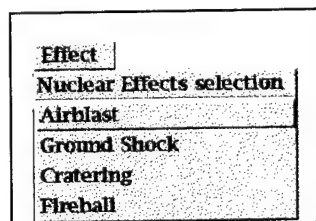


Figure C-3. MID Effect Menu.

The **Series menu** allows the user to select which of the several available series of nuclear explosion tests is to be examined. As currently configured, the available series are Hardtack, Plumbbob, Teapot, Tumbler, Upshot-Knothole, Small Boy, and Sedan. When

NEDMAS is first started, none of the *Events*, *View*, or *Data* menus contain any entries; the *Images* and *Overlay* menus contain a few items that are relevant to NTS as a whole as well as some images of general interest. Upon selecting a series, the context-sensitive menus fill in with items relevant to the series, and the locations of events from the series are shown on the SPOT® image of NTS as icons (red boxes with a center dot to indicate the detonation point). To proceed, the user selects one of the available Series from the menu. Figure C-4 contains the *Series* menu for airblast data.

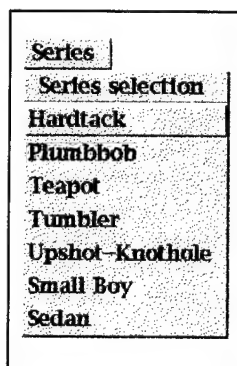


Figure C-4. MID Series menu.

The **Events menu** is filled in with events from a particular series once a series has been selected. Contents of the menu are built from a database of events available to NEDMAS. To select an event, the user presses the *Events* menu button and chooses one of the listed events. Upon selection of an event, the context-sensitive menus fill in with data relevant to the selected event, while a green diamond outlines the location of the event on the SPOT® image. Figure C-5 shows the *Events* menu for series Teapot.

Once an event is selected, the **View menu** fills in with a set of views available for the chosen event. As currently configured, NEDMAS provides a full-resolution (10m/pixel) SPOT® image of NTS immediately surrounding the event's detonation point, a color-coded topographic map of the area around the detonation point, and a general geologic map for NTS as a whole. Whichever view the user selects, the application displays the image and indicates the location of the event's detonation point with an icon. All views chosen in this way are registered to geographic coordinates, so overlaid icons may be displayed equally well on all views. Figure C-6 shows the *View* menu for event MET.

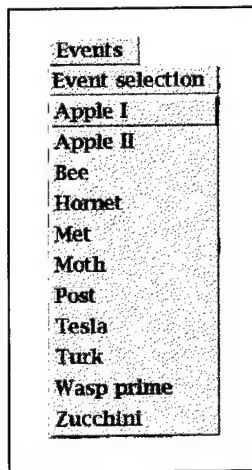


Figure C-5. MID Events menu.

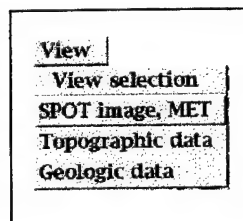


Figure C-6. MID View menu.

The **Data menu** contains a list of available data for the selected event. Such data may include overpressure, dynamic pressure, total pressure, static pressure, Mach number, fireball photography, ground motion, and cratering data as available. Since all data types are not available for all events, only the relevant types are shown for a specific event. When the user selects a data type from this menu, locations of instruments that collected the data are shown on the image, represented by yellow boxes with center dots representing the instrument locations. Figure C-7 shows a sample data menu as it would appear if all of the effects data types could appear at once.

Images specific to the chosen event are accessible via the **Images menu**. The user may elect to view any image at any time by selecting one from the menu. After looking at the images, the user must restore the View by selecting the appropriate entry from the *View* menu. Selections having a right-pointing arrow on the item bring up a submenu. Figure

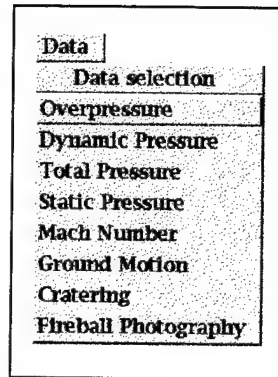


Figure C-7. MID Data menu.

C-8 shows a sample *Images* menu containing two items that would cause submenus to be displayed and one item that would display an image.

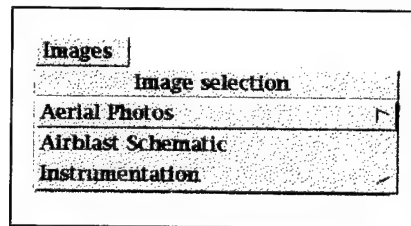


Figure C-8. MID Images menu.

The **Overlays menu** gives the user access to digitized line data for the specified event. It also provides access to data digitized by the user, as discussed below. Figure C-9 shows a sample *Overlay* menu from the MET event. The final entry in each *Overlay* menu, called Digitized overlays, brings up a submenu containing overlays that have been constructed via the digitization feature of NEDMAS.

The **Functions menu** is partly context-sensitive. That is, its contents do not vary according to the selections made in the Series and Events menus, but the data used in

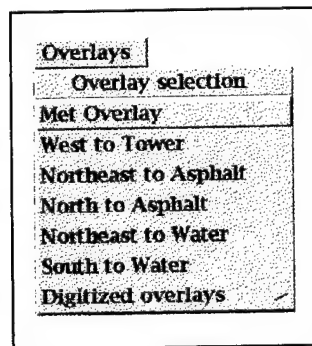


Figure C-9. MID Overlays menu.

some displays depends on the selections. Figure C-10 illustrates the *Function* menu for airblast.

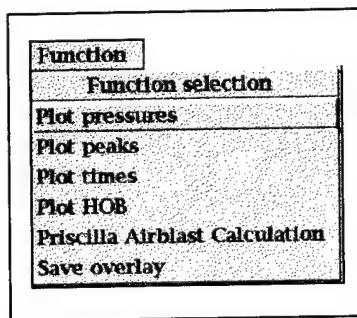


Figure C-10. MID Functions menu.

Its contents and their functions include:

- Plot Pressures - plot pressures as recorded at selected instruments, discussed in more detail in section C.4.
- Plot Peaks - for the selected event, display a plot of Peak Pressure versus Range. Discussed in more detail below.
- Plot Times - for the selected event, display a plot of Arrival Time versus Range. Discussed in more detail below.
- Plot HOB - for the selected event, plot scaled height-of-burst versus scaled range, and shows measured peak pressure versus modeled peak pressure in color. Discussed in more detail below.
- Priscilla Airblast Calculation - present graphical results of an off-line finite difference calculation for series Plumbbob event Priscilla. The plots show the calculated pressure vectors as a function of location versus time after the explosion.

- **Save Overlay** - this provides a mechanism by which the user can save digitized overlays.

The **Copy button** on the Menu Bar captures the image to a file. When the user presses this button, a dialog box asks for the name of a file to which the screen image is to be saved. Screen images are saved to whatever directory the user was in when NEDMAS was launched in a form suitable for output to a printer.

The **Help menu** provides access to a series of pages of text describing how to use every NEDMAS application. Figure C-11 shows the Main Image Display help menu. Help topics are displayed after selection in a dialog box, as shown in Figure C-11. Help topic dialog boxes can be scrolled by manipulating a slider on the right side of the text window, and can be dismissed via a button at the bottom of the box.

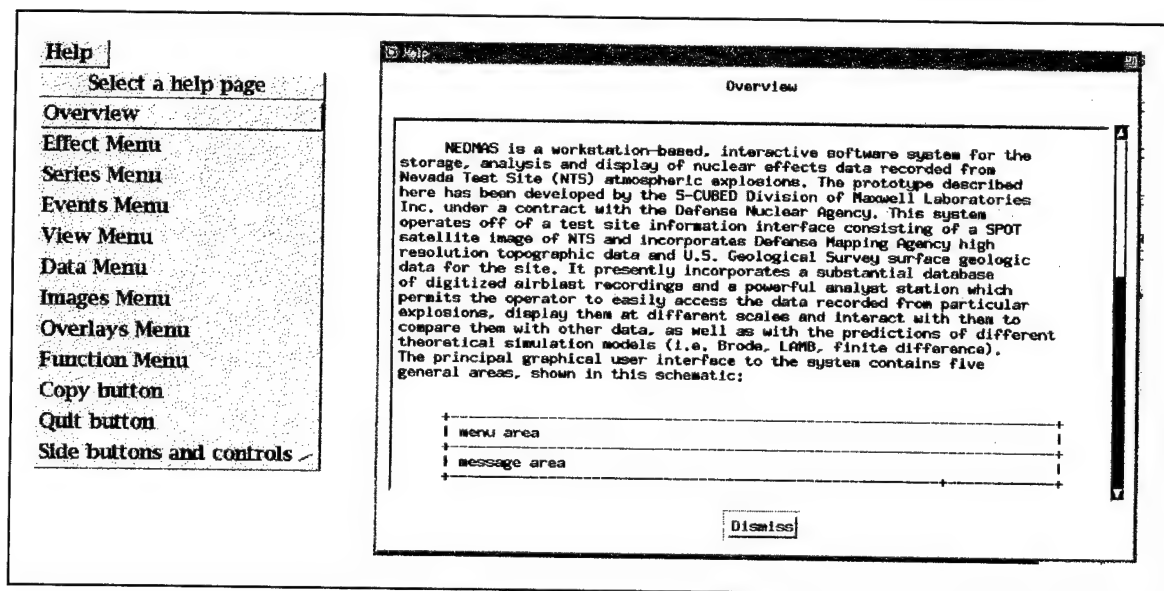


Figure C-11. MID Help menu and a Help dialog box.

Pressing **Quit** causes the application to terminate execution. The *Quit* button is shown as a component of the main menu in Figure C-2.

C.2.2 Message Area.

The Main Image Display provides textual output in response to certain actions. If the amount of text is small, it is displayed in this area of the display. The message area appears just below the main menu, as shown in Figure C-2.

C.2.3 Side Menu.

The behavior of the left mouse button in The Main Image Display varies according to the settings of the radio buttons in the side menu. (The name radio buttons derives from car radios, meaning that only one of them may be selected at any time.) The radio buttons are shown in Figure C-12. A small diamond is associated with the text of each button; when the button is selected, the diamond fills with a bright color to indicate the current state of the radio buttons.

Brief descriptions of the actions performed when the left mouse button is pressed when the function is enabled are:

- Information - pressing the left mouse button on an object in the Image Area causes information about that object to be displayed. Depending on the amount of information available, it may be displayed in the Message Area or in a dialog box.
- Lat/lon - shows the latitude and longitude of any point in a geo-registered image (i.e., a SPOT® image, a color-coded topographic map, or the geologic map).
- Select Station - allows the user to select data collection stations to be displayed by the time-series plotters, discussed below.
- Compare - allows the user to select data collection stations at similar distances from the detonation point by clicking on only one of the stations. Used with the time series plotters, discussed below.
- Digitize - permits the user to digitize arbitrary points on any image. If the image is geo-registered, latitude and longitude are used for coordinates; otherwise, pixel locations are used.
- Cross sec - after the selection of two points, plots a vertical cross-section between the points.
- Rotatable Cross sec - similar to Cross sec, but the user selects a center point and an endpoint; the length of the line is doubled about the center point and a cross-section is displayed. A companion dialog box permits the user to view cross-sections at various azimuths about the defined center point.
- Magnify - presents a magnified view of the area surrounding a mouse-selected point. Magnification is controllable to values between 2 and 6 via a companion dialog box.

The Main Image Display includes some display-altering controls on the side menu labeled Contrast and Brightness. These controls alter the contrast and brightness of grayscale images by means of sliders. Pressing the *Contrast* or *Brightness* buttons restores those parameters to their original values. The contrast and brightness controls are shown in Figure C-13.

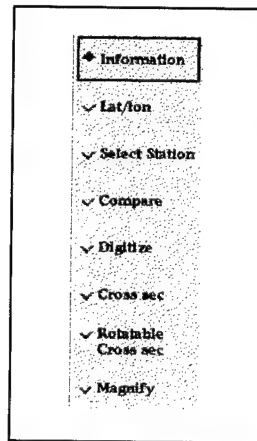


Figure C-12. MID side menu.

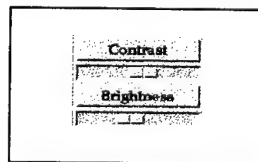


Figure C-13. MID Contrast and Brightness controls.

C.2.4 Image Area.

Almost all of the information communicated by NEDMAS is displayed in the Image Area. The user can interact with the image, if appropriate, via the mouse and according to the selection in the Side Menu, as discussed above. Many examples of images displayed in this region of the Main Image Display are shown in Chapter 2.

C.3 CROSS-SEC.

The cross-section display is launched from the main image display application when either the *Cross sec* or *Rotatable Cross sec* side menu buttons are selected. See the discussion under the previous section for more details about creating a cross-section. Both methods of creating cross-sections use the same cross-section display application.

The cross-section display contains a menu bar, a message area, and an image area. The functionality of the mouse is limited to two functions, controlled via a menu from the menu bar. Data are taken from a digitized elevation model of the Nevada Test Site.

C.3.1 Menu Bar.

The menu bar of the Cross-sec display contains several buttons, some of which cause menus to be displayed. The menu buttons are labeled *State*, *Function*, *Copy*, *Help*, and *Quit*. The contents of all of the menus are static, i.e., they always contain the same selections, but the data on which they operate are dependent upon the data included in the particular cross-section on display. Figure C-14 shows the menu bar of this application.

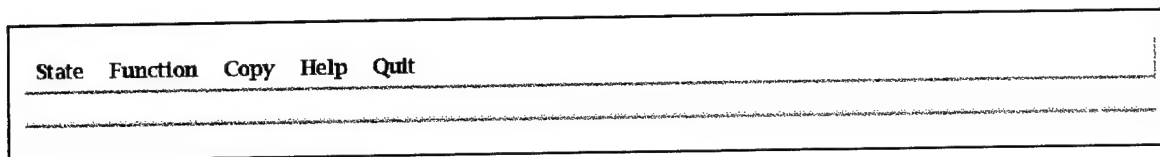


Figure C-14. The Cross-section main menu and message area.

The **State menu** allows the user to specify the behavior of the left mouse button. The default setting is Information. Figure C-15 shows the State menu.

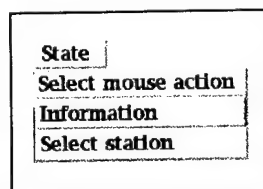


Figure C-15. Cross-sec State menu.

Brief descriptions of the actions performed when the left mouse button is pressed are:

- **Information** - pressing the left mouse button on an object in the Image Area causes information about that object to be displayed. Depending on the amount of information available, it may be displayed in the Message Area or in a dialog box.
- **Select Station** - allows the user to select data collection stations to be displayed by the time-series plotters, discussed below.

The **Functions menu** is partly context-sensitive. That is, its contents do not vary according to the data displayed in the cross-section, but the data available to the Plot Pressures application depends upon what is displayed. It contains a single working entry, *Plot Pressures*, that performs the same function as the Functions menu item of the same

name described in the previous section, that is, it plots pressures as recorded at selected instruments, discussed in more detail in section C.4. The Function menu is illustrated in Figure C-16.

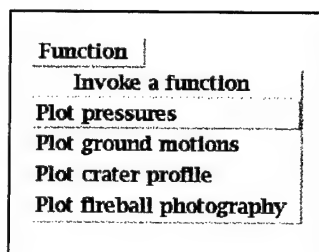


Figure C-16. Cross-sec Functions menu.

The **Copy button** on the Menu Bar captures the image to a file. When the user presses this button, a dialog box asks for the name of a file to which the screen image is to be saved. Images are saved to whatever directory the user was in when NEDMAS was launched. See Figure C-14 for the position of the *Copy* button on the main menu.

The **Help menu** provides access to a series of pages of text describing how to use the application. Figure C-17 shows the Cross-sec help menu. Help topics are displayed after selection in a dialog box. As discussed above, help text is displayed in a dialog box containing a scroll bar and a facility to dismiss the dialog box; see Figure C-11 for an example of a help dialog box.

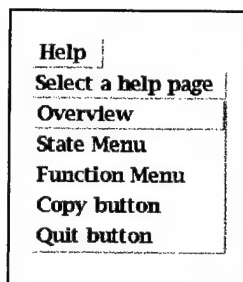


Figure C-17. Cross-sec Help menu.

Pressing the **Quit button** causes the application to terminate execution. See Figure C-14 for the location of the *Quit* button on the main menu.

C.3.2 Image Area.

The image area of Cross-sec contains a cross-section along the line selected from The Main Image Display. Horizontal and vertical scales are shown in the image. The vertical exaggeration of the cross-section is determined by the vertical size of the display area: cross-sections are scaled to fill the display with a small border at the top and bottom.

If instrument and/or device icons are present and the *Information* state of the mouse has been selected, the user can query the icons for information about the objects represented. If the *Select Station* state of the mouse has been selected, the user can select instruments whose data may be displayed by choosing *Functions*⇒*Plot Pressures*.

C.4 ANALYST STATION TIME SERIES ANALYSIS MODULE.

The analyst station displays time series versus elapsed time from the beginning of the digitized record. The display contains a main menu bar, a message area, and an image area containing one or more plots of time series. If there are more time series than will fit on a single screen, a scrollbar will appear along the right edge of the image area; the user can drag the scrollbar down to see time series that didn't fit on the initial display. Each time series is plotted in its own window, including amplitude and elapsed time scales along with text indicating the range, azimuth from detonation point, elevation of instrument, environment, and installing organization. Data are taken from digitized waveform files.

C.4.1 Menu Bar.

The menu bar of the analyst station contains menu buttons labeled *Predict*, *Options*, *Tools*, and *Help*; and three action buttons, labeled *Refresh*, *Copy*, and *Quit*. The menus are static but operate on the data included in the analyst station when it is launched.

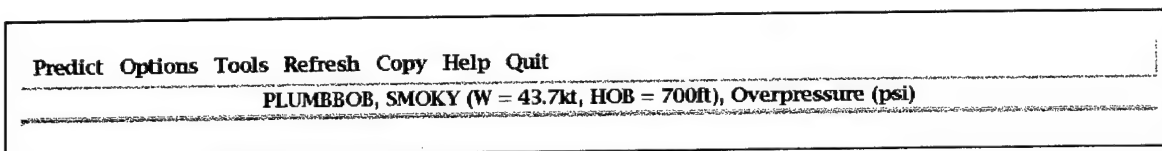


Figure C-18. Analyst Station menu bar.

The **Predict menu** gives the user access to a variety of airblast and ground motion models. Choosing an option from this menu will cause a model to be calculated, if appropriate, and displayed as an overlay to each time series so that the user may compare modeled time series with measured data. Figure C-19 shows this menu.

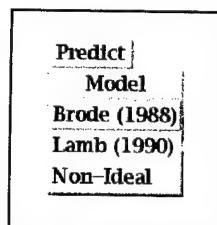


Figure C-19. Analyst Station Predict menu.

The models available are:

Brode (1988) - Upon choosing this airblast model, a dialog box appears in which the user can select yield and height-of-burst by means of sliders; initial settings of these parameters match those for the event being displayed in the analyst station. If the user elects to continue, pressing the *Apply* button at the bottom of the dialog box causes the application to calculate and plot the model for each yield and range represented in the display. Pressing *Cancel* on the dialog box dismisses it. Figure C-20 shows this dialog box.

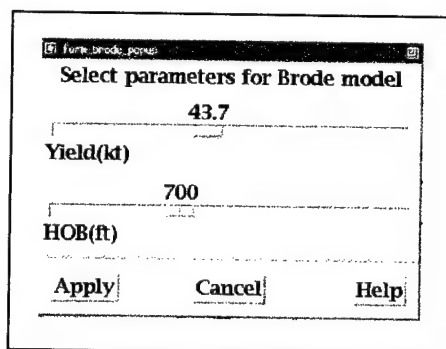


Figure C-20. Brode model parameters dialog box.

- **LAMB (S-Cubed 1983)** - Upon choosing this airblast model, a dialog box appears in which the user can select yield, height-of-burst, and height of instrument by means of sliders; initial settings of the first two parameters match those for the event being displayed in the analyst station, while the initial setting for height of instrument is always zero. Pressing the *Apply* button at the bottom of the dialog box causes the

application to calculate and plot the model for each yield and range represented in the display. Pressing *Cancel* in the dialog box dismisses it. The dialog box is illustrated in Figure C-21.

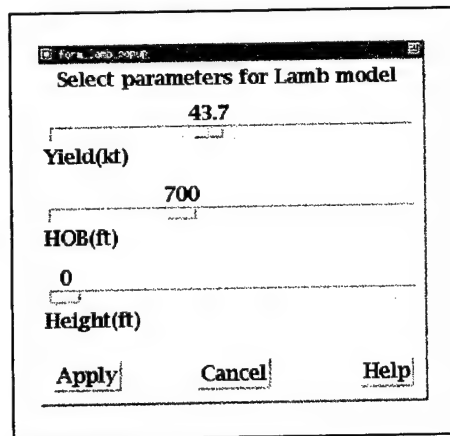


Figure C-21. LAMB model parameters dialog box.

- Non-ideal (Needham et al., 1994) - This airblast model incorporates a more realistic set of parameters and more elaborate modeling techniques than either the Brode or LAMB models. It was calculated offline on a supercomputer; therefore only the results are available in NEDMAS. Time series for this model are available for only one event: series Plumbbob, event Priscilla.
- Ground motion - this model provides access to offline theoretical ground motion simulation results for selected events.

The presentation of the data by the analyst station can be manipulated via the **Options menu**. In all cases, choosing an entry from this menu brings up a secondary menu from which the user may make a selection. Figure C-22 shows this menu and its submenus.

The options available are:

- Amplitude Scaling - the way the pressure axes of the several time series are presented.
 - ◊ Relative scaling (the default) - each time series is drawn so that it fills its display window, i.e., is scaled to a unique size based on its maximum pressure value
 - ◊ Absolute scaling - all time series in a display are scaled to the maximum pressure shown in the display, so that the pressures shown in different times series may be compared more meaningfully.
- Yield Scaling - controls whether pressure data are presented as recorded or normalized to an event of standard size
 - ◊ No scaling - pressure data are presented as they were recorded

- ◇ $W^{1/3}$ - pressure data are scaled according to a cube-root scaling law to normalize all explosions to a standard event, namely 1 kiloton at sea level. This is useful in comparing time series from different events.

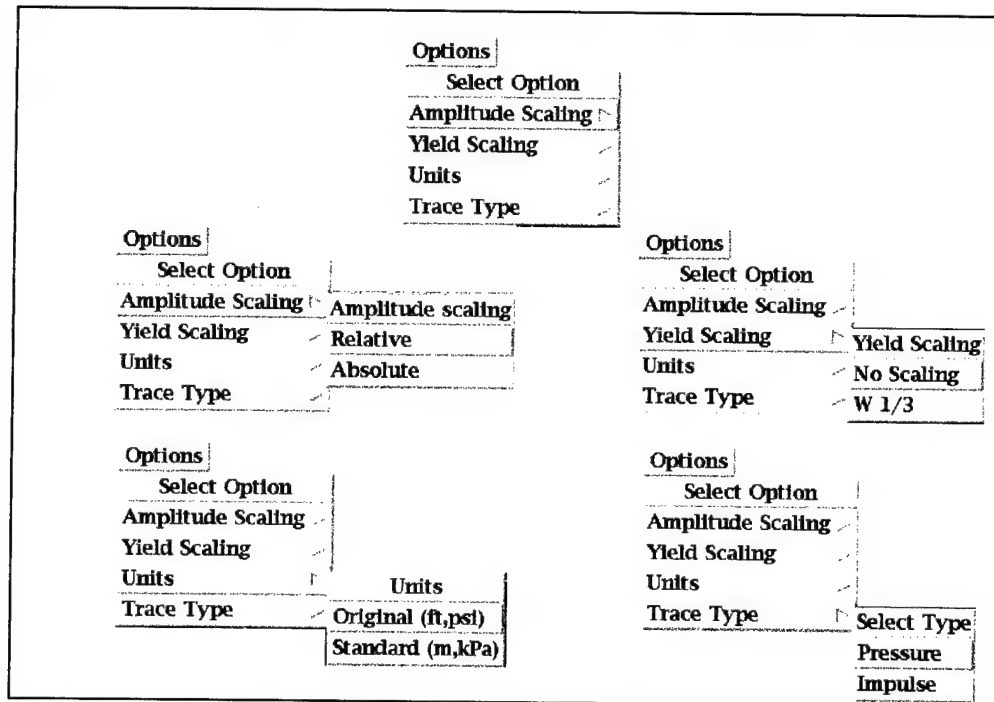


Figure C-22. Analyst Station Options menu and its submenus.

- Units - specifies the units in which pressure and distance data are presented
 - ◇ Original (ft, psi) - data are presented in the English units feet and pounds per square inch
 - ◇ Standard (m, kPa) - data are presented in SI units meters and kiloPascals
- Trace Type - determines whether pressure data are shown as instantaneous pressure or as accumulated total pressure
 - ◇ Pressure - data are shown as instantaneous pressure over time, in units of pressure
 - ◇ Impulse - data are shown as pressure integrated over time, in units of pressure-time

The **Tools menu** allows the user to interact with the data in various ways. This menu is shown in Figure C-23.

The choices available are:

- Expand - produces a full-page display of any selected time series. A second instance of the analyst station is started to display this single time-series, so all other functionality of the analyst station may be brought to bear on the trace.

- Clone - produces a moveable colored copy of any selected time series. The user may then drag the copy around the display to overlay it on another time series to examine similarities. The first mouse-click selects the trace to be copied; a second mouse



Figure C-23. Analyst Station Tools menu.

click dismisses the copy. If the user holds the left mouse button down after the first click, the copy will move smoothly over the display; alternatively, if the user releases the left mouse button after the first click, the copy will jump from location to location after a computer-system-set threshold time has passed.

- Measure - allows the user to measure pressure and elapsed time anywhere on a time series plot. To use this, move the mouse cursor to the desired location on the trace and press the right mouse button. Note that one can measure pressure and time at any location in the time series display window, not just on the waveform.
- Compare - upon selecting the Compare tool and clicking on a time series, the application searches the database for pressure measurements taken at similar scaled heights of burst and scaled range. A dialog box will appear that contains a list of all time series matching the search criteria, with the original trace shown at the top. The user can select individual time series for display by clicking once on each desired time series, and can deselect time series by clicking a second time on it. Alternatively, there are *Select All* and *Deselect All* buttons at the bottom of the dialog box that can be used. When the user is satisfied with the selection of time series, press the *Ok* button at the bottom of the dialog box to start a second instance of the analyst station that shows the selected similar time series for comparison to the original time series.
- Plot Peaks - for the selected event, display a plot of Peak Pressure versus Range. Discussed in more detail below.
- Plot Times - for the selected event, display a plot of Arrival Time versus Range. Discussed in more detail below.

- **Plot HOB** - for the selected event, plots scaled height-of-burst versus scaled range, and shows measured peak pressure versus modeled peak pressure in color. Discussed in more detail below.

The **Refresh button** causes the display to be redrawn. This button is visible on Figure C-18.

The **Copy button** on the Menu Bar captures the image to a file. When the user presses this button, a dialog box asks for the name of a file to which the screen image is to be saved. Images are saved to whatever directory the user was in when NEDMAS was launched. See Figure C-18.

The **Help menu** provides access to a series of pages of text describing how to use the application, as described in previous sections. The Help menu is shown in Figure C-24.

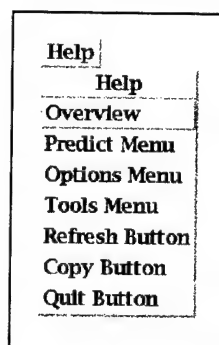


Figure C-24. Analyst Station Help menu.

Pressing **Quit** causes the application to terminate execution.

C.4.2 Image Area.

Plots of time series are displayed here. Each time series is displayed in its own subwindow. If there are too many time series to be displayed at reasonable size on the screen, a vertical slider at the right side of the image area enables the user to scroll the display to view more time series plots.

C.5 COMPARE.

The time series comparison module is a specialized version of the analyst station, dedicated to displaying results of the *Tools*⇒*Compare* operation from the analyst station. Labels of individual time series contain both observed and scaled values, and the menus contain a subset of the options available under the analyst station. See section C.4 for more information.

C.6 PLOTPEAKS.

This application is launched by choosing *Function*⇒*Plot Peaks* from the Main Image Display. It shows peak pressures at all instruments as a function of range from the detonation point. The display comprises a menu bar, a message area, and an image area. Data are taken from a database table.

C.6.1 Menu bar.

The menu bar in PlotPeaks contains two menu buttons and three action-producing buttons. The menu buttons are *Units* and *Help*, while the action-producing buttons are *Refresh*, *Copy*, and *Quit*. See Figure C-25.

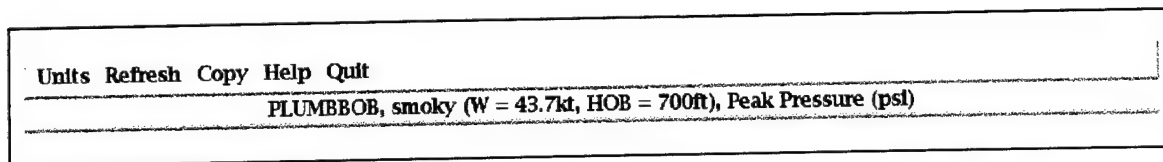


Figure C-25. PlotPeaks main menu and message area.

The **Units menu** allows the user to specify the units in which pressure and distance data are presented. This menu is illustrated in Figure C-26. The choices are:

- Original (ft, psi) - data are presented in the English units feet and pounds per square inch
- Standard (m, kPa) - data are presented in SI units meters and kiloPascals.

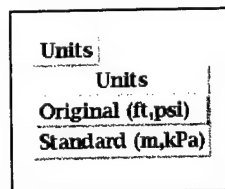


Figure C-26. PlotPeaks Units menu.

The **Refresh button** causes the display to be redrawn.

The **Copy button** on the Menu Bar captures the image to a file. When the user presses this button, a dialog box asks for the name of a file to which the screen image is to be saved. Images are saved to whatever directory the user was in when NEDMAS was launched

The **Help** menu provides access to a series of pages of text describing how to use the application. See Figure C-11 for an example.

Pressing **Quit** causes the application to terminate execution.

C.6.2 Image Area.

The image area contains a plot of peak pressure versus range. It shows the peak pressure at each instrument as a box, and additionally has the results of Brode and LAMB modeling plotted. The user can interrogate each instrument by clicking on its box with the mouse; the instrument under examination is highlighted with a blue diamond. The result of the interrogation shows up as a dialog box, and the user must dismiss the dialog box via its *OK* button before another instrument can be interrogated. There's no provision for selecting among many instruments when they lie too close together on the plot, so in some cases it's not possible to find out about certain instruments. Clicking on a location away from the boxes (i.e., in the background area of the plot) interrogates whatever instrument is closest to the mouse click.

C.7 PLOTTIMES.

This application displays the time of first positive pressure in milliseconds after detonation, as measured from the original data. The data come from a database.

C.7.1 Menu bar.

The menu bar in PlotPeaks contains two menu buttons and three action-producing buttons. The menu buttons are Units and Help, while the action-producing buttons are Refresh, Copy, and Quit.

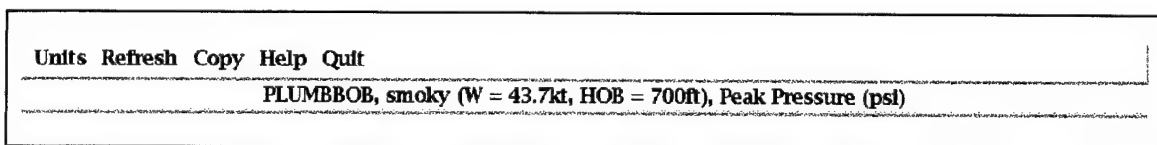


Figure C-27. Plot Times Main Menu and Message Area.

The **Units** menu allows the user to specify the units in which pressure and distance data are presented. The choices are:

- Original (ft, psi) - data are presented in the English units feet and pounds per square inch
- Standard (m, kPa) - data are presented in SI units meters and kiloPascals

The **Refresh** button causes the display to be redrawn.

The **Copy** button on the Menu Bar captures the image to a file. When the user presses this button, a dialog box asks for the name of a file to which the screen image is to be saved. Images are saved to the directory the user was in when NEDMAS was launched.

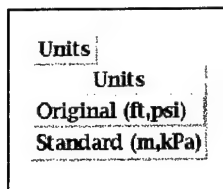


Figure C-28. Plot Times Units menu.

The **Help** menu provides access to a series of pages of text describing how to use the application. See Figure C-11 for an example.

Pressing **Quit** causes the application to terminate execution.

C.7.2 Image Area.

The image area contains a plot of the time of first arrival after detonation versus range. It shows the arrival time at each instrument as a box, and additionally has the results of Brode and LAMB modeling plotted. The user can interrogate each instrument by clicking on its box with the mouse; the instrument under examination is highlighted with a blue diamond. The result of the interrogation shows up as a dialog box, and the user must dismiss the dialog box via its *OK* button before another instrument can be interrogated. There's no provision for selecting among many instruments when they lie too close together on the plot, so in some cases it's not possible to find out about certain instruments. Clicking on a location away from the boxes (i.e., in the background area of the plot) interrogates whatever instrument is closest to the mouse click.

C.8 PLOTHOB.

This application shows three dimensions of data in a 2D display by using color. The horizontal axis is ground range scaled by a cube-root scaling law, and the vertical axis is height-of-burst, also scaled by a cube-root relation. The background of the display is a color contour map of pressure as a function of height of burst and range, as calculated by

the Brode model (Brode 1986). Scaled measurements from individual events are shown as boxes overlying the background contour map to allow comparison of measurements with the model.

PlotHOB has a menu bar, a message area, a side menu area, and an image display area.

C.8.1 Menu Bar.

The menu bar contains one menu trigger and two action-inducing buttons. The menu bar is shown in Figure C-29.

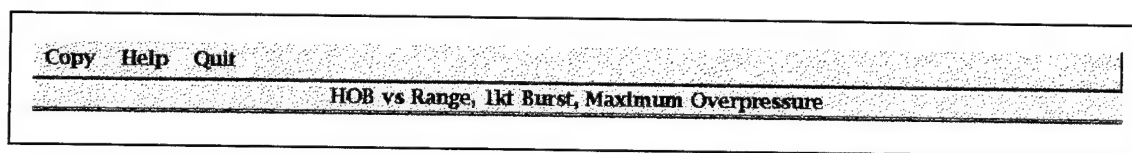


Figure C-29. PlotHOB main menu and message area.

The **Copy button** on the Menu Bar captures the image to a file. When the user presses this button, a dialog box asks for the name of a file to which the screen image is to be saved. Images are saved to whatever directory the user was in when NEDMAS was launched

The **Help menu** provides access to a series of pages of text describing how to use the application. See Figure C-11 for an example.

Pressing **Quit** causes the application to terminate execution.

C.8.2 Side Menu Area.

The behavior of the left mouse button in PlotHOB varies according to the settings of the radio buttons in the side menu. (The name radio buttons derives from car radios, meaning that only one of them may be on at any time.) Figure C-30 illustrates the side menu. The radio buttons, and brief descriptions of the actions performed when the left mouse button is pressed when the function is enabled, are:

- **Information** - when the user clicks on a measurement box, the name of the event during which the measurement was made is displayed in the message area, and a dialog box appears that reports information about the scaled data resulting from the measurement. There is no provision for choosing a particular measurement from among a series that are closely located on the plot.

- Range, HOB - reports the scaled range and height-of-burst of a particular background point.
- Expand - displays a dialog box with text boxes containing settings for X Start and X End, Y Start, and Y End. When this dialog box is visible, the user can draw a box around an area of interest on the PlotHOB display, select *OK* on the dialog box, and see a full-screen expansion of that area. This is the only way to examine individual data points in crowded areas. There's no provision to get back to the full-screen display; the user must quit PlotHOB and restart it.

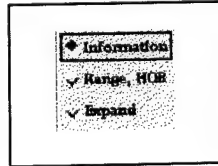


Figure C-30. PlotHOB side menu.

C.8.3 Image Area.

PlotHOB displays data in three dimensions: scaled range (horizontal component of distance of the instrument from the detonation point) and scaled height-of-burst are shown as horizontal and vertical axes, while scaled pressure is represented by a color keyed to a colorscale that appears at the right side of the image area. Color-coded boxes indicate individual instruments mapped into this scaled space. A color contour map of scaled pressure calculated by the Brode model (Brode 1986) is used as background.

APPENDIX D

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